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Christmas Thoughts.

WE go to press with this issue on the eve of the Christmas Holidays when most of the ordinary occupations of trade and professional electrical men are being put aside for a few days.

Contractors and retailers will be engaged until Saturday night completing their sales of electrical gifts and making up their accounts, which in many cases will constitute a record as the outcome of the National Shopping Campaign begun early in the month. By Sunday morning everybody electrical will have entered upon the period of peace and goodwill and family reunion, though we shall all remember our electrical confréres such as power station and distribution staffs, telephone and telegraph staffs, electric tramway and railway men, and others who have to be at their posts maintaining the public and private services upon which millions of the population will be in some way or other dependent. To all of these emergency men and women we give a special thought as we wish every reader of the ELECTRICAL REVIEW "A Merry Christmas!" But we have not in these sentences mentioned all who should be remembered, for notwithstanding the satisfactory condition of most sections of the electrical trade and industry, there are many men who have to face this Christmas season under the depression of unemployment. As we have watched the course of unemployment returns lately, we may have felt thankful for the active state of the electrical trade and the signs of improvement, yet for most of us very few days pass without some case being brought to our notice of a qualified electrical man who has long been eager to find work but has failed in the search, and is feeling the pinch and, what is far worse, seeing the effect upon his family.

We are hopeful for further improvement in the electrical position in 1928 as more large contracts are placed and as the general demand for small electrical products grows, but when at the opening of the Christmas festivities we are confronted with cases of necessity, our sympathies naturally take a practical turn, and

while we would urge those who are in a position to do so to assist personally when they know they will be rendering aid wisely, we would suggest to others that this is an appropriate moment for sending an additional mite to the Electrical Trades Benevolent Fund (Mr. F. B. O. Hawes, 36-38, Kingsway, W.C.2) or to the Institution of Electrical Engineers Benevolent Fund (Savoy Place, Victoria Embankment, W.C.2).

There is another direction (not expressly electrical) that we would mention as being worthy of everybody's support. We make no apology for alluding to it again here. We have hundreds of thousands of boys and girls growing up amongst us without any prospect of earning a livelihood within these islands for many years to come unless there is a trade boom of unparalleled extent. Many of them could soon be started in the bracing atmosphere of other parts of the Empire where they are wanted—lands full of new opportunities, another part of Home really—if only some big brother or sister here would find the few pounds for which under some Empire Settlement Scheme, or through the instrumentality of some of the recognised societies, they can be equipped and transferred.

The reader is being appealed to on every side to extend an open and a generous hand at this time; we have briefly mentioned a cause or two which we hope will not be lost sight of by electrical men.

Electricity Supply Charges Reduced.

WHILST our pages last week were passing through the press, the County of London Electric Supply Co., Ltd., was circulating a notice to the effect that substantial reductions in the price of electricity would be made throughout its area of 200 square miles, to date from the end of the current quarter, and would be followed by further reductions six months later, the total decrease in the case of electric lighting being in some parts as much as 2d. per kWh. The present lighting rate is approximately 7d. per kWh—the tariff varies somewhat in different parts of the Company's area—and the immediate reduction is said to be 1¼d. or 1½d. per kWh (in Camberwell it is from 7.15d. to 6.5d. for householders). The charge for heating and cooking will be reduced to 1½d. per kWh, and though this is still much more than some other London companies charge, the improvement will be heartily welcomed by the long-suffering consumers on this undertaking's mains. The power tariff will also be cheapened.

It is pointed out that these reductions are not made under the Act of 1925, the "standard prices" not yet having been fixed in accordance with that Act; when they are settled they will come into force as from January 1st, 1926, but they will not affect the prices charged to consumers—their function is to regulate the dividends that may be paid. Neither has the Act of 1926 had anything to do with the matter.

We have no doubt that the Company's undertaking will benefit as the result of this belated move towards cheaper, if not cheap, electricity. For a long time there has been an under-current of dissatisfaction amongst its customers, who, being without any representative organisation, have writhed in impotence. Recently, however, as noted in our pages, some Borough Councils have taken action on their behalf.

We hope that, having at last set its face in the right direction, the County of London Company will persevere in the endeavour eventually to supply electricity as cheaply as its neighbour companies, even if it is unable—on account of the large scale of its operations, the high efficiency of its Barking super-station, the great length of its mains, and the other qualifications which are so dear to the hearts of the Electricity Commissioners and so dear to the pockets of consumers—to approach the standard set by the London Borough Councils. Whilst the profits made by the Company during recent years have been large, we do not find fault with that so much as with its notorious lack of enterprise. Its mains in residential areas lie practically idle except during the evening hours—without increasing their section or adding a stick to the plant, an enormous load could be carried in off-peak hours by quoting an up-to-date tariff for "other uses of electricity" in the household. At present an electric cooker on the Company's mains is an object of interested curiosity to its meter-readers, who, when they learn what it is, are amazed at the assumed extravagance of the owner. It pays the latter to cook by electricity even at 2d. per unit; but it would pay the Company handsomely to supply him at 1d., and if it would embark upon a forward policy, hiring-out cookers and other domestic apparatus, encouraging the installation of thermal storage in the night, and otherwise developing the off-peak load, it would not only be carrying out the spirit of the Acts of 1919, 1922, and 1926, but would also be cultivating goodwill amongst its customers and rendering that public service for which purpose it was granted a monopoly.

The Work of the Electricity Commissioners.

THE seventh annual report of the Electricity Commissioners was issued on Friday last week; it has increased considerably in bulk, comprising 193 pages, 16 of which are devoted to a very interesting review of the progress of the electricity supply industry during the past seven years, in which period the generating plant installed in central stations has doubled in capacity, as the result of individual rather than of co-operative effort. Steady progress has been made in the promotion of bulk supply, but less than 10 per cent. of the total output was dealt with in that way last year, and the Commissioners consider that their policy in that respect has not received a full measure of support from the industry; local interests have had the preference, and apparently the owners of stations have been somewhat too optimistic in their estimates of generating costs. The Commissioners lament the reluctance of central-station managers to co-operate in giving and taking a bulk supply, and in the latter case ascribe it to some extent to the fear that the status of an undertaking will suffer if it ceases to generate. There is no doubt that the Commissioners' view is well-founded, and having in mind the prospective closing of many more generating stations, they appeal for recognition of the importance of distribution and the necessity of skilled management for this work. We agree with them entirely, though we fear that no persuasion will convince the station engineer that he is likely to be better off without a power station

Dealing with supply and distribution, the Commissioners review the progress made towards uniformity of frequency and voltage, but are by no means satisfied with its extent, and here again they appeal for the fullest co-operation on the part of the industry. Unfortunately in many cases, especially those of small undertakings, it is found that existing distribution networks are inadequate to deal with the increasing domestic load, with the result that the undertakers discourage that class of demand; the Commissioners rightly condemn the failure of such supply authorities to discharge their obligations, though they admit that when a company's business is liable to be purchased by the local authority at an early date the position is difficult. This is another example of the evils of legislative interference with a young and growing industry.

The readiness of authorised undertakers and other bodies to promote schemes and to obtain supply powers for extended areas since the war is the subject of comment; 329 Special Orders have been granted, and the number of authorised undertakers increased from 532 to 623 in seven years. The consumption of electricity for power increased by 50 per cent. in five years, but for domestic purposes by no less than 113 per cent., and it is clear that there is vast scope for further development. The average yearly expenditure charged to capital account was over £18,330,000.

Electrical Development in Russia.

A review of the progress made in the U.S.S.R. since the pre-war period, and of the programme drawn up by the State Electrification Commission.

By LOUIS SEGAL, M.A., Ph.D.

THE public supply of electricity in the Soviet Union has made extensive progress during the last five years, and at present both the number of stations and the output of electricity by far exceed those of the pre-war period. The figures for 1913, when compared with those for 1927, will clearly illustrate this. While in 1913 the output in the territory of the present Soviet Republics amounted to 1,945 million kW, during the 1926-27 financial year (October 1st, 1926 to September 30th, 1927) the output was 4,100 million kW.—so that the output has been more than doubled since 1913. Not only has the output increased, but the stations have grown considerably, both in number and size, since before the war, and they are being utilised to a greater extent. In 1913 the output capacity of the stations was 1,077,000 kW., while by October 1st, 1927, it had increased to 1,690,000 kW.

The irregular development of electricity, which was characteristic of the pre-war period, has now given place to a systematic construction of stations and utilisation of electrical energy. The production of electricity is being concentrated in a number of central stations where it can be generated most cheaply and to the greatest advantage. As far as possible, the new large electric stations are built with a view to utilising local fuel supplies or hydraulic power.

As a result of the concentration of the production and supply of electricity, stations supplying energy to factories are utilised to a greater extent, while electricity is being introduced in a number of factories which depended before on other sources of energy. While in 1913 only 37.9 per cent. of the total electrical energy produced was used for industry, in 1925-26, 64.1 per cent. was so utilised. Electricity is at present used only sparingly for transport purposes and almost exclusively by tramways. The energy so used is approximately the same as in 1913; thus the increased supply of electricity is utilised principally for lighting and industrial purposes. The number of houses which use electric light has increased enormously in Russia, and this increase took place even during the worst years of economic disorganisation. At present, not only is a large number of suburbs supplied with electricity, which used ordinary paraffin lamps before the war, but also in a number of villages electric lighting has replaced the primitive methods of illumination. Though the supply of electric energy to villages is still in its infancy, the number of peasant households using electric lighting has increased from 10,000 in 1917, to more than 91,000 in 1927.

The demand for electricity, both for industrial and lighting purposes, in many instances exceeds the supply. In spite of the intensive work on electrification, many applicants for electric energy have to be refused because of the inadequacy of the supplies, but when all the generating stations at present under construction are completed it is estimated that this demand will be satisfied.

The plans elaborated by the State Electrification Commission—which are now being carried out—aim at concentrating the generation of electrical energy in a number of large stations which will feed sub-stations over extensive areas. From the very beginning attempts have been made to utilise hydraulic resources, peat, and brown coal for the production of electricity. In the first year of the existence of the Soviet Government the construction of the Volkhov electric station in Leningrad began, and a similar station was planned for Svirsk, the construction of which has been commenced only recently. Even before the elaboration of the plans of the State Electrification Commission the construction of two electric stations—the Red October in Leningrad, and the temporary Shatura station in Moscow—had begun; these stations use peat fuel and are fitted with specially constructed boilers, the invention of Professor Makariev, which reduced the quantity of peat consumed per kWh by one-half.

At the same time the construction of the Kashira electric station was commenced. This is using coal obtained near Moscow. A little later the Kiselov power station was started and equipped for the burning of local low-grade coal, this being the first attempt to utilise such fuel for the production of electrical energy.

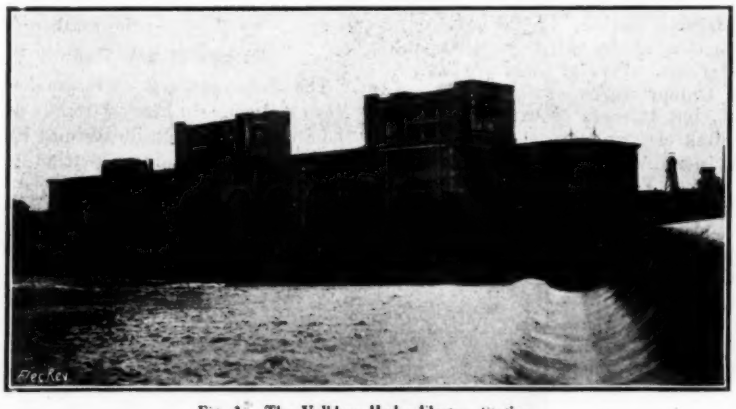


Fig. 1.—The Volkhov Hydro-Electric Station.

The State Electrification Commission has elaborated a programme, drawn up in three parts, for the electrification of the country. Part I deals with means to be adopted for the maximum utilisation of existing stations; part II contains the plans for the construction of thirty district stations, with a total output capacity of 1,500,000 kW (these stations were to be erected within 10 to 15 years); and part III deals with those areas where there will not be a need for large district stations in the near future, but only for small local ones.

Parts I and II of the programme were elaborated in detail, while part III was not completed, and contained only indications as to how to proceed in those areas where moderate-sized electric stations were required with the best means for the utilisation of local fuel resources.

Part I of the programme was entirely carried out two years ago. The most difficult and extensive is part II—the erection of large district stations. In 1922 began the realisation of this part of the programme. At first, eight district electric stations were started; two of these, the Volkhov station in Leningrad, 56,000 kW, fig. 1, and the Zemo-Aschalsk station, 13,000 kW, are using water power. Three stations are using peat as fuel—the Shatura, 48,000 kW, fig. 2, which is being now increased to 136,000 kW, the Red October, 20,000 kW, which is now being increased to 108,000 kW, and the Nizhni-Novgorod station for

20,000 kW, which is being increased to 86,000 kW. Three stations use local coal as fuel—The Kashira (near Moscow), 12,000 kW, which is being extended to 78,000 kW, the Shterov station in the Donetz basin, which is using anthracite dust as fuel, 20,000 kW, and is being extended to 86,000 kW, and the Kiselov station in the Urals, which uses local brown coal, 6,000 kW, and is now being extended to 28,000 kW.

In 1926 the construction of a series of four district stations, which are to use coal as fuel, began—the

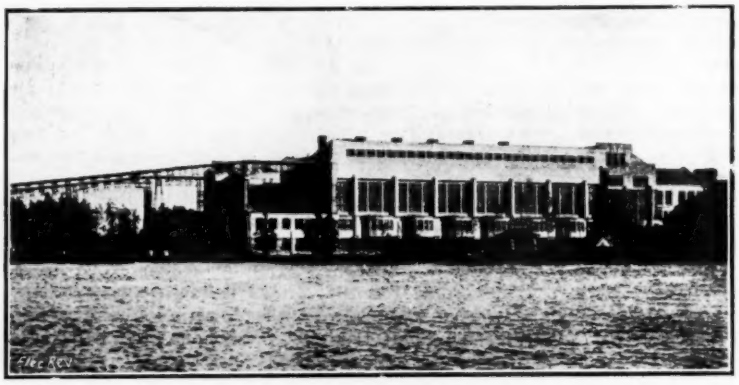


Fig. 2.—The Shatura Peat-Fuel Station.

Chuguev station near Kharkov, 44,000 kW, the Shakhtinsk station in the south eastern section of the Donetz basin, to use anthracite dust (this station will supply energy to Rostov-on-Don), the Kiev electric station, 22,000 kW, and the Saratov station, 11,000 kW.

In 1927, the construction of the third group began, consisting of eleven stations. Five of these are hydro-electric stations: the Dniepr works, 220,000 kW (at first only 105,000 kW, but later to be extended to its full capacity); the Svirsk electric station, 80,000 kW; the Gizeldon station, near Vladikavkas, 21,000 kW: the Rionsk station near Kutais, 21,000 kW, which together with the Zemo-Aschalsk hydro-electric station, fig. 3, will supply energy to a section of the Trans-Caucasian Railway; and the Dzoraget station in Armenia, also for 21,000 kW. The last mentioned will supply a number of factories at present under construction.

Three peat stations are under construction, one in Ivanovo-Voznesensk, 44,000 kW, one in Bryansk, 22,000 kW, and the other in Osinovsk, in the White Russian Republic, 22,000 kW. Another station has been constructed in Chelyabinsk, in the Urals, 44,000 kW. This will burn brown coal. Two stations, one in Novorossisk, 22,000 kW, to supply energy to the cement industry, and the other in Krasnodar, 11,000 kW, will use oil fuel.

In addition to the new erections, a number of stations in Moscow, Leningrad and Baku are being extended. The capacity of the district electric stations in the whole of the present territory of the Soviet Union, which amounted in 1916 to 245,000 kW, has now been increased to 500,000 kW. The capacity of the district stations at present under construction or being extended will amount to 1,100,000 kW. The programme elaborated by the State Electrification Commission is being carried out to the extent of 92 per cent., and the whole programme will be completed before the estimated period of ten years has elapsed.

The plans of the State Electrification Commission do not include electric construction in Transcaucasia, where one district station has already been constructed and two more are now being built.

In addition to the district stations, a number of large local ones have been erected, or are under construction at the present time; for example, the Lyapinsk station, near Yaroslavl, 5,000 kW, which uses peat as fuel. This station is ultimately to be extended to 19,000 kW. The Sverdlovsk peat-fuel station has a capacity of 6,000 kW, the Kondopozh hydro-electric station, 5,000 kW, the Adzharus-Tskhalsk hydro-electric station, near Batoum, 5,500 kW, while the recently erected Erivan hydro-electric station has a capacity of 2,200 kW, and is now being extended to double that figure. The new Tashkent hydro-electric station is of 2,000 kW, and a number of local electric stations at present under construction have a total capacity of 75,000 kW.

Work is also proceeding in connection with the construction of a number of electric stations at factories, and in places where district stations are either non-existent or are insufficient to supply the local needs in accordance with part III of the programme elaborated by the State Electrification Commission. The total capacity of the factory electric stations at present under construction is approximately 600,000 kW.

Success of S.A. Railway Electrification.

The Johannesburg correspondent of the *Financial News* says that in his last report as general manager of the South African Railways and Harbours, Sir William Hoy draws particular attention to the success of electrifying the Natal railway from Glencoe to Pietermaritzburg. Recently, he states, in one day 34,000 tons of goods was dispatched in the downward direction. This record tonnage was moved without difficulty, and if sufficient traffic had been available an additional 3,000 tons could have been transported with the same facility, making a total possible tonnage of 37,000 tons, as compared with a maximum of 25,000 tons carried under steam conditions. The scheme was designed to handle 30,000 tons per diem, and Sir William Hoy has always maintained that it is fully capable of dealing with this quantity of traffic; also that its capacity could be increased to 40,000 tons per diem by the addition of further power plant and locomotives. Experience with electric traction in Natal, it is stated, shows that the maximum advantages will not be obtained until the line is electrified from Maritzburg to Durban, and Sir William Hoy has definitely recommended the Administration to proceed with the electrification of the section without delay.

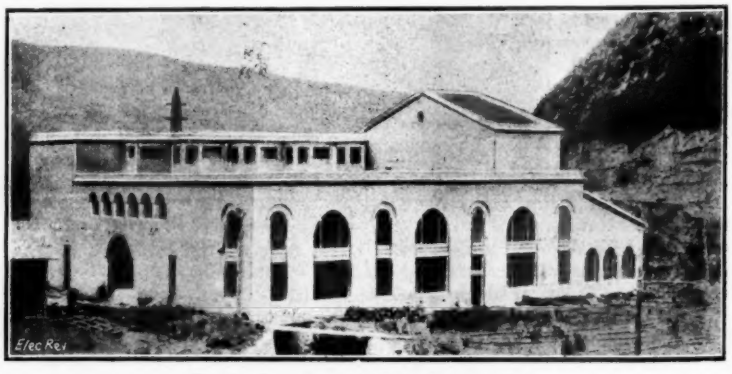


Fig. 3.—Zemo-Aschalsk Hydro-Electric Station.

The Wembley Greyhound Track.

Some details of the electrical equipment, which includes duplicate "hare" apparatus and provides for flood-lighting totalling about 500,000 c.p.

OF the numerous greyhound racing tracks which have been established and equipped in different parts of the British Isles, that which has just been opened at Wembley is claimed to be outstanding in regard to its equipment. The famous Stadium, which has been adapted for the purpose, is not only equipped with the most up-to-date electrical equipment by means of which the elusive "hare" is propelled and controlled, but has, in addition, it is claimed, one of the finest flood-lighting systems ever installed for any purpose. The hare-propulsion equipment at Wembley is similar in general principle to that at most of the tracks which have been established. It is, of course, necessary on the track to obtain as natural an effect as possible, and, with this end in view, the means for propelling the "hare" are kept out of sight.

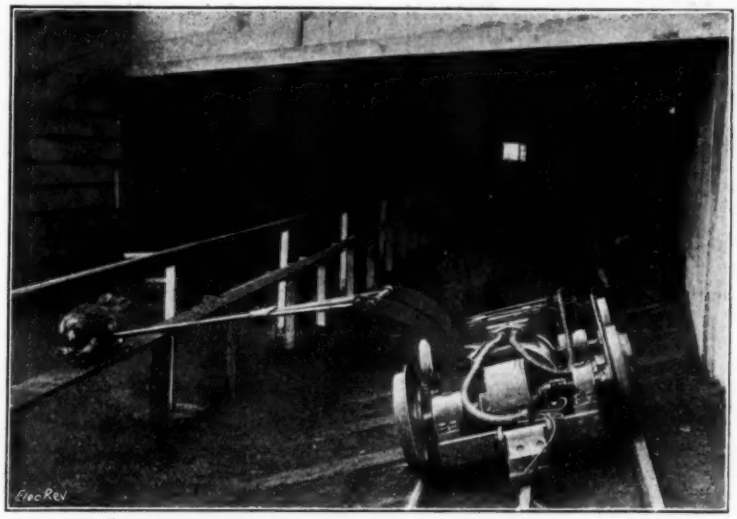


Fig. 1.—"Hare" and Trolley in Braking Siding.

All round the course a sunken trackway is constructed, and in it a narrow-gauge railway is laid. The trackway is covered in, a continuous opening in the woodwork being left on the side nearest the course through which projects the arm carrying the "hare," which runs on a rubber-tired wheel on a wooden insert let into the course the whole way round. The projecting arm is fixed to an electrically propelled truck, fig. 1, which runs on the rails in the sunken trackway, the power for the driving motor being collected from a centrally disposed insulated third rail. The current returns *via* the track rails, these being suitably bonded. To minimise the flashing, in order not to disturb the dogs during the race, the collecting device is duplicated, one section being carried in the front and the other at the rear end of the truck; the possibilities of sparking are still further reduced by separately exciting the field of the driving motor from a battery of accumulators carried on the truck.

It is essential that the variations in speed of the "hare" should be rapidly and reliably controlled, so that it can be always kept just ahead of the racing dogs, and to effect this with certainty the truck is designed with a four-wheel drive, so as to obtain the maximum adhesion possible, and thus avoid wheel slip. To ensure speedy acceleration and deceleration, a high power is provided, and a rigid bogie is employed with the wheel base as short as practicable to simplify the construction.

The d.c. driving energy is provided by one of two motor-generator sets, fig. 2, installed in the control building. These machines, with the other essential parts of the equipment, have been duplicated in order to safeguard as far as possible against breakdown.

The running of the truck is controlled by one operator from the control-tower observation room, fig. 3, which is so situated as to command a full view of the racing at all times. The maximum speed of the "hare" is varied by altering the voltage of the track circuit by means of a liquid controller in the field circuit of the supply generator. To reduce the speed very quickly, however, the attendant operates a push-button, which, through suitable contactor gearing, breaks the supply to the track circuit and short-circuits the armature of the truck motor through a low resistance, thus producing rapid dynamic braking. On releasing the button the truck regains its speed, according to the position of the rheostat.

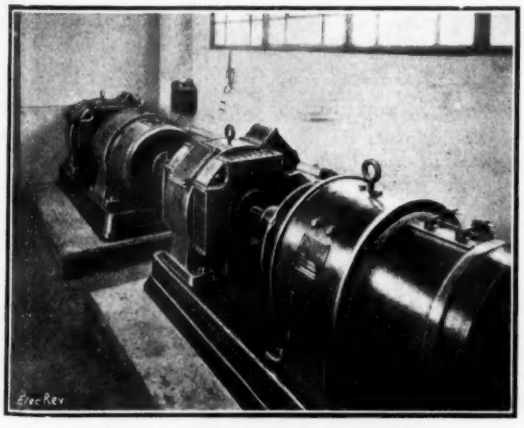


Fig. 2.—The Motor-Generator Sets.

Fig. 3.—Control Tower Observation Room.

Before a race commences, the "hare" is run round the track; immediately it has passed the boxes in which the greyhounds are confined, the dogs are released and spring out in pursuit. The attendant keeps the "hare" ahead of them until the run is completed, and

Fig. 4.—Illumination Equipment for Covered Stands.

then switches the truck into a siding, when the "hare" disappears through a hole in the woodwork at the side of the course and the dogs cease to run. It is necessary to stop the truck very quickly on the siding, and for this purpose it is fitted with a specially designed brake, consisting of two lined brake shoes mounted on each side of the truck in the centre of the wheel base. These are pressed outwards, under the influence of powerful leaf springs, against wooden braking rails situated at each side of the siding track. Each brake shoe is made in two portions, the outer part, carrying the friction surface, being pivoted on the inner one in such a way that it can be arranged on an incline to facilitate the return of the truck to the track. The braking shoes reset themselves when clear of the siding.

When it is remembered that the truck has to be subjected to speeds of up to 50 m.p.h., and capable of an acceleration of upwards of 2.5 miles per hour per second, it is difficult to see how any means of propulsion other than electricity could have been employed.

Fig. 5.—Open-Enclosure Lighting Apparatus.

The track is provided, it is claimed, with the highest flood-lighting illumination for any track in the country, the intensity being practically uniform at 20 foot-candles throughout. The floodlighting equipment includes over 3,000 electric lamps, totalling about half a million candle-power. A remarkable feature is that no direct light can be seen by the spectators, so that while the arena is bathed in evenly distributed light, all dazzle effect is eliminated. The lighting system employs the standard equipment of Messrs. Metro-Vick Supplies, Ltd. The stands are illuminated to an average of 5 foot-candles by "Cosmos" 200-W lamps with vitreous reflectors, fig. 4. The uncovered enclosures are illuminated by twenty chromium-plated floodlights, fig. 5, each of which is equipped with a 1,000-W floodlight lamp, and 55 similar floodlights provide the general lighting of the grounds of the Stadium, including the pedestrians' entrances, car parks, and so on. Fig. 6 gives an impression of the Stadium track by night. Sixty "Nile-white-way" street lanterns are utilised for outlining the boundaries and providing illumination on the roadways and steps leading to the Stadium entrances.

The Stadium-Club lighting is also very striking; 230 200-W gasfilled lamps in special trough reflectors mounted 6 ft. above the floor are installed for this. These are placed round the columns and pilasters, and are sheltered from view by fret and silk screens which are illuminated from inside by means of a light spill from the troughs. The result is an indirect effect with the addition of a beautifully coloured silk relief at the eye level. The illumination intensity, obtained by measurement after installation, is 10 foot-candles. Provision has been made for colouring effects by the insertion of coloured glass covers in the troughs, should this be required in the future.

Fig. 6.—The Stadium Track at Night.

A notable feature of the lighting installation is the fact that the work, which included the laying of about 30 miles of cable and 10 miles of conduit, was completed by Messrs. Metro-Vick Supplies, Ltd., within ten weeks from the placing of the contract.

The whole of the electrical equipment for the Wembley installation was supplied by the Metropolitan-Vickers Electrical Co., Ltd., which has taken a prominent part in the development of some of the most important electric-hare and track-lighting systems in the country, and has also patented the specially designed truck brake.

The Great Electrical Hare Contest.

The accounts for this contest have now been audited and found correct by Mr. Matthew Short, Newcastle-upon-Tyne Electric Supply Co., Ltd., and show that the contest has raised over £422 for the E.T.B.I. funds. This is, of course, after paying all expenses and taking into account sundry subscriptions and the E.T.B.I. tax on bets. The ball resulted in a profit of about £60, and it is hoped that some benevolent friends in the North will make the total sum up to £500; it would mean only an additional subscription of under £20.

Transmission-Line Lightning Surges.

The author discusses the influence of long spans upon the height of line and on induced lightning surges, and the relative merits of long spans and those of medium length.

By R. C. ANDERSEN, M.C., A.M.I.E.E.

LIKE everything else, transmission-line design has its fashions. Some time ago, a bird fever unsettled the land, and the most fascinating part of transmission-line design was centred in bird protection. The leakage path of insulators had a protracted and royal reign; and now we have arrived at a stage of development when long spans and heavy loading form the *pièce de résistance* of transmission-line discussion. Perhaps the "grid" is responsible for this new and interesting twist to theories.

Origin and Experience of Long-Span Construction.

The long-span conception found its origin in mountainous countries where, owing to the topography of the route, no other form of construction was expedient. In the earlier stages of development, though, engineers took care that high mechanical loading should not occur, and it was not till a good deal later—when costs of material and labour had risen appreciably—that the long-span vogue took hold in territories which, like ours, are relatively flat. It will thus be seen that the long span was essentially an economic development.

Judged solely from the standpoint of low initial capital cost, there is everything to be said for the long span. True, it had the disadvantage of requiring strain insulators of very high ultimate mechanical strength, but the insulator manufacturers, buckling-to, produced the necessary porcelain. Conductor clamps, too, proved to be a genuine difficulty, but this was also overcome; thus, by virtue of these attainments in the sphere of accessory design, the relatively cheap long-span transmission line became a reality which gladdened the hearts of both engineers and (principally) financiers.

Alas for soaring hopes! Only one or two lightning seasons were required to prove that the new construction had grave disadvantages, nor was the trouble located in the insulators. It was implicit in the height above ground at which the conductors had to be erected

As illustrative of the tendencies of the time, it is interesting to note as typical the case of an important American power company, which increased its clearances to ground from bottom cross-arm from roughly 50 to 60 feet. Similar increases were common.

The grave disadvantages to which allusion has been made were found to lie in the direct influence of the height of conductors on the value of induced lightning charges. The higher the towers, the greater the number of "outages" that were experienced due to destructive flashes-over of insulator strings. Altogether the lines weathered the lightning seasons very badly.

The Work of F. W. Peek, Junr.

Mr. F. W. Peek, Junr., whose research work in the domain of dielectric phenomena at high voltages is classic, has carried out an exhaustive investigation into the effect of transmission-line height on induced lightning surges. As a result we are now possessed of a law which for all practical purposes is quite specific, which he has laid down briefly as follows: —

> "The maximum induced voltage that can appear on a transmission line is independent of the line voltage, and is determined largely by the height of the conductor. Thus:
>
> $$v = \sigma h$$
>
> where v = Induced voltage on line
> σ = Voltage gradient due to lightning
> h = Height of conductors above ground."

The immense importance of "h" is obvious. It is the only factor over which the designer has complete control, and although there are certain measures to which allusion will be made later, the taking of which will add very considerably to the stability of the line, nevertheless the fundamental character of "h" as an influence on stable line operation cannot be questioned; see curve below.

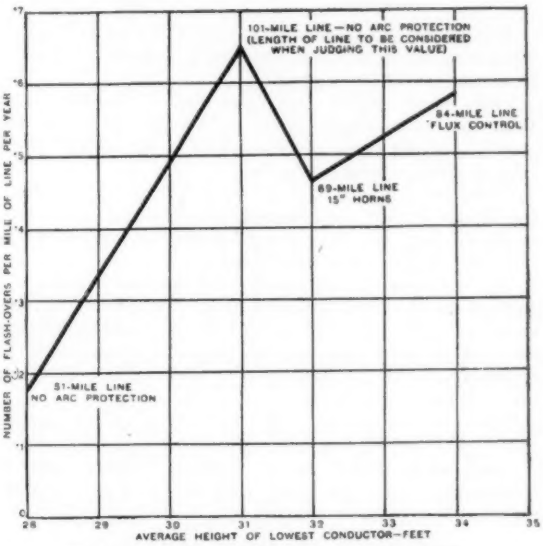


Fig. 1.—Flashes-over Registered on a 140-kV System.

Conditions in Britain.

From the standpoint of transmission-line stability (I know of no other), we are fortunate in having summers which are often conspicuous by the absence of seasonable conditions. Thus, relatively speaking, our lightning seasons are innocuous. Nevertheless, it would be obvious folly were we not to design our lines in accordance with the best practice to cope with the ill-effects of induced lightning voltages.

Based on operating data available and bearing in mind English climatic conditions, lightning gradients between 10 kV and 50 kV per foot may readily be experienced. The higher value would be exceptional, and the lower probably normal, with 30 kV per foot as a gradient which might readily be accepted as a basis when considering the design of e.h.p. networks.

* As the "grid" is to function at 132 kV, we have a definite basis on which to speculate regarding a suitable height for the lines about to be erected. It is an interesting speculation, regarding which individual opinions will certainly vary appreciably. For my own part, assuming a string of eight orthodox (10 in. diameter) cap-and-pin type insulators as normal for 132 kV, I would like to see a minimum clearance between lowest conductor cross-arms and ground of 40 feet. Given a 20-foot minimum clearance between conductor and ground, this would permit of a reasonably long span (600 feet approx.) with the size of wires generally used on this type of network. A line constructed as

* This was written before the issue of Specification No. 651 for the Central Scotland scheme.

indicated will also just release, by flash-over of insulator strings, induced lightning charges created by voltage gradients of 30 kV per foot.

Conductor Disposition.

This question of minimum clearance between lowest cross-arm and ground brings one to the best procedure to adopt in the matter of conductor disposition.

It is a well-known fact that on lines erected conventionally with conductors spaced vertically one above the other, the great majority of insulator flashes-over take place over the top conductor strings. Sometimes the top and middle conductor strings flash over simultaneously, but it is a comparatively rare occurrence for flashes-over to occur over the bottom string. These effects are logical, and the following illustrative flash-over percentages are derived from an analysis of a considerable number of flashes-over that occurred in one year on a 132-kV double-circuit transmission line:

Top	81%
Middle	12%
Bottom	5%

There were 85 flashes-over in the period—a sufficiently large number to warrant drawing a definite conclusion from the percentages given.

From these figures and from Peek's formula, it is clear that for single-circuit (three-phase) lines, the erection of the three conductors in a horizontal plane is undoubtedly to be preferred.

When large amounts of power are to be transmitted, the double-circuit line becomes inevitable. Here, just as inevitably, the triangular conductor formation, on each side of the structure, holds.

The designer is now faced with having to erect his conductors at a height above ground which for 132 kV must be such that the values of induced lightning charges that will occur on the lines are considerably in excess of the impact flash-over of his insulation. How, then, is he to proceed?

One thing is certain. He has still sufficient control over "*h*" not to run riot with excessively long spans. A compromise based on a careful balance between economies, on the one hand, and electrical advantages, on the other, must be effected.

Measures for Line Protection.

Having decided on his span, the following measures of (additional) protection, to ensure efficient functioning of the line, are open to the designer:—

(*a*) Choice, disposition, and method of erection of earth-wire.
(*b*) Method of protecting insulator strings against damaging effects of arcs-over.
(*c*) Earthing.
(*d*) Safety switching and protection apparatus.

It is not within the compass of this article to deal in detail with these measures of safety; but as the first three items are intimately associated with the functioning of the line, these should be touched on briefly. Safety switching and protection apparatus is an independent subject which requires separate treatment.

Earth-Wire.

Experiment has proved conclusively that the installation of an earth-wire acts as an electrical screen, resulting in a reduction of the induced lightning voltage on a conductor by 30 per cent. approx. Peek gives a reduction of two-thirds with two earth-wires, and three-quarters with three.

Considering these very definite findings, it is curious to note that for a short period, prior to the knowledge we now possess regarding the effect of tower height, the earth-wire fell into disfavour. The reason appears to have been that as this wire's functions were purely electrical—and negative at that—much light wire was installed. Indeed, the wires were so light, and so little care was taken to see that proper attachments were used, that a great deal of trouble was experienced with breaking earth-wires. They were removed. There followed lightning troubles to such an extent that they were hurriedly replaced, and now the earth-wire is accepted as a most important element of e.h.p. construction. It should have a section comparable to that of the conductors, and its most effective position is at some point above the conductors.

Whether or not the earth-wire should be insulated from the top hamper when wood poles are used is a very important and interesting consideration, regarding which the last has not been heard. Certainly wood is beginning to be used more and more for e.h.p. work, and Mr. A. O. Austin, alive to the tendency, has carried out a series of most original experiments which illustrate the efficiency of an insulated earth-wire as a means of increasing the impact flash-over values required to bridge a given string of insulators. The combination of wood poles and insulated earth-wire, or of the latter used with wood and structural steel combined for longer spans, may quite conceivably eventuate in our being able, to a great extent, to neutralise the disadvantages inherent in the factor "*h*," which have already been dealt with.

Insulator String Protection.

Though the means employed to protect insulator strings cannot, like the earth-wire, be utilised to "control" the values of induced flash-over voltages, nevertheless string protection does result in a high level of line operating efficiency being reached.

Whereas arcing horns—top and bottom—can be considered as adequate all-round protection for insulator strings (four units in series) functioning at 66 kV, for voltages above this value the bottom horn should be replaced by an arcing shield. The latter, if properly designed, will ensure "impact" arcs being kept clear of the insulator string. Failing the shield, impact arcs will curl into and envelop approximately the top third of the string. Damaged porcelain and fittings will result.

Earthing.

Efficient earthing should be employed throughout, for experience has shown that lightning line troubles are much more frequent on those sections where the ground has been found to have a high resistance. In such circumstances it is not enough to rely on the normal protection afforded by single earthing devices. Either additional earthing must be provided, or else the usual artificial methods must be adopted to ensure low-resistance earth round the earthing points.

Conclusion.

Modern transmission-line construction should be such that relatively little trouble is experienced from induced lightning surges.

The insulator shield and horn and the earth wire are, in a manner of speaking, palliatives which owe their origin to lightning troubles experienced on old lines. Those were the days before we knew very much about lightning. Thanks to the klydonograph, however, and the work of such men as Peek, Norinder, and Simpson, the mechanism of lightning has been very effectively analysed. We now know that line height is a direct function of induced voltage surges. But line height, happily, is under the complete control of the designer, and it is therefore up to him from the start to use sound discrimination in the choice of span length—"which is more truly economic," he must ask himself, "the long span with its obvious saving in initial outlay, but possible lightning trouble; or the more expensive, though much more surge-proof medium span?"

Overhead Cable Risks.

Lecturing on overhead transmission lines last week, Mr. E. Moxon, electrical engineer to Southport Corporation, said that crows were their greatest enemies. They sat on the wires making love to each other and when they kissed they caused a short circuit which put the whole line out of service.

Human Nature in Business.

Some Observations on a Book written by Mr. F. Creedy, M.I.E.E.

By ED. C. de SEGUNDO.

SOME eighty-six years ago, Emerson remarked in the course of a lecture delivered at Boston, U.S.A., that "the ways of trade are grown selfish to the borders of theft, and supple to the borders (if not beyond the borders) of fraud. The employments of commerce are now vitiated by derelictions and abuses at which all connive." But a great many years before that, much the same sentiment was recorded in the Book of Ecclesiasticus in these words: "As a nail sticketh fast between the joinings of the stones, so doth sin stick close between buying and selling." The part played by human nature in business is probably very much the same to-day as it has been throughout historic times, and it is only the *mode* in which the "human element" finds expression that has altered with the changing customs and methods induced by the ever-increasing interdependence of nations brought about by the economic pressure of increasing population.

All of us—or perhaps we might say, most of us—feel that the "ways of trade" are not always quite consistent with the ethical code which is generally professed, nor in harmony with the basic principles of any of the religions of the world. "Business," like charity, often covers a multitude of sins. Men of the strictest integrity in their private relations with their fellow-creatures do not seem to hesitate to resort, in business dealings, to innumerable tricks and devices, varying from "sailing near the wind" to downright deception and dishonesty. It will not be denied by any who have had much experience of business methods in any part of the world, that the axiom "One man's necessity is another man's opportunity" is more frequently acted upon than not, and if the necessity does not exist, it is not altogether outside the sphere of practical business politics deliberately to set about creating the necessity in order to take advantage of it.

In an interesting volume entitled "Human Nature in Business" (Ernest Benn, Ltd. Price 12s. 6d. net), Mr. F. Creedy, whose achievements in the world of electrotechnics entitle his views to serious consideration, deals with the evils with which our industrial system undoubtedly teems, and exposes many abuses of the system of which a large section of the community is probably ignorant.

Mr. Creedy deals at considerable length with two inherent evils of our industrial system, namely, the principles of "bargaining" and the jealously guarded "trade secrets," whereby the dissemination of useful knowledge, which is an essential factor in national industrial progress, is prevented.

"The practice of bargaining," says Mr. Creedy, "produces a peculiar mentality in the business man. He regards the fixing of prices as a kind of game in which someone wins, and someone loses, instead of merely a calculation of what constitutes a fair remuneration for a given amount of work, and he expects the other side to do the same." Mr. Creedy puts down the rules of bargaining as *selfishness* (in that each party is out to consider his own interests only); *secrecy* (in that each party only publishes such facts as support his case); *deception* (which is virtually included in secrecy); and *prudence* (that a bargaining advantage should never be pushed to an extreme, because a harsh bargainer soon becomes known as such). We fear that this analysis is not far wide of the mark and that there is much justification for the author's condemnation of the crop of evils arising out of "bargaining." But bargaining is a dominant factor in competition, and experience goes to show that competition "tends to work itself out." Some thirty or forty years ago the essential qualification for a salesman was that he should be able to persuade a customer to buy something he did not want at a price he could not afford to pay. Advertisements were notoriously unreliable. To-day business methods are changing rapidly. Salesmen are instructed to endeavour to make customers realise what they *do* want, and in the majority of instances the customer gets value for his money, because it is now becoming more and more widely recognised that the best advertisement is a satisfied customer. Lying advertisements are, to a great extent, things of the past, and in the United States, notably, an immense and increasing volume of satisfactory business is transacted by "mail orders" on the strength of advertisement.

The trust movement is the inevitable consequence of "competition working itself out." Whether the ultimate development of this movement will inure to the real benefit of the community is a difficult question. While combinations and amalgamations of like industries and industrial activities upon which such industries are dependent seem unavoidable in the present-day trend of economic relationships, there is this very real objection to be considered that such movement does away with competition and leaves no scope (except for the few men governing the trust) for individuality and enterprise, to which the old economists were not far wrong in attributing the immense commercial development of the nineteenth century.

Furthermore, the art of combination is not a monopoly. Every form of industry is composed of those who direct, and those who carry out directions; in other words, management and wage-earners. There is nothing to prevent either combining. The trust movement is the result of the organisation of management, and the trade union movement is the result of the organisation of the wage-earners. Both these forms of trust are to-day only in their infancy. In each we find indications of a house divided against itself. Should either one or the other ultimately consolidate in such fashion as to give it a decided "bargaining advantage" over the other, the result could not fail, it would seem, to be disastrous to the welfare of the community at large, unless a much higher moral standard be adopted by both sides than that described by Mr. Creedy as underlying present-day bargaining.

Mr. Creedy makes no secret of his sympathy with the teaching of Ruskin, and few of us will quarrel with the axiom that every normal member of the community *should* justify his existence by rendering adequate service of some description in exchange for whatever benefits he derives from being a member of that community. But the difficulties in even imagining *how* this could be carried into effect are insuperable. There are such immensely wide variations in the ability, physical constitution, mentality, aptitudes, and so on, of individuals, that no man, or body of men, could possibly judge of the relative value of any service rendered by any particular individual. Mr. Creedy devotes a long chapter to a consideration of the organisation needed to render his ideals effective, and while we are in sympathy with the critical portion of this section of his work, we must leave to the reader any judgment upon the practicability of the suggested organisation. He deals at some length with the important question of providing the means of fostering new industries and enterprises which clear-sighted men perceive to be necessary in order to maintain the efficiency of industry, as a whole, at the level which will keep the country abreast of foreign industrial development. The author states that a century of experience has shown that although increased efficiency in industry tends to reduce the number of men employed, the new

industries which spring up (or should be encouraged to spring up) will be capable of absorbing the labour released by higher efficiency, *provided that these new industries develop sufficiently rapidly*. As an academic proposition, this may be true enough, but as a matter of practice it is difficult to see how it can be accepted as a solution of the unemployment problem (as the author suggests it would be) unless the number of workers to be employed be kept at a figure reasonably commensurate with the "work-need" of the community as a whole. Surely Mr. Creedy will not seriously suggest that employment *could* at all times be found for an *unlimited* number of workers? This is one of the fallacies of Socialism and of other altruistic schemes of social reform. The fact is overlooked that a community of X people calls for Y units of work per annum to supply their needs, and if it requires A workers to supply this "work-need" at a living wage, it is quite impossible to find employment for 2A workers at the same wage.

Moreover, the "work-need" never remains constant for any great length of time. Fluctuations in the demand for specific commodities, or activities, are caused by changes in fashions, by alterations in the tastes or requirements of the public, by new discoveries or inventions and a host of other causes, thus rendering a *permanent* solution of the problem of unemployment utterly impossible by any conceivable practicable form of organisation. Again, the term employment covers both manual and mental labour, and *ability* is a dominant factor in the exchange-value of both forms of activity. How can the "coefficient of ability" in each individual possibly be regulated, or determined, by any form of organisation?

The dominant idea underlying Mr. Creedy's book is expressed in the following words in the concluding chapter entitled "The Aims of Civilisation." He says: "Material advance is impossible without moral advance." Throughout the whole work, we find this ideal uppermost. Early in the book he says: "If the prime axiom of industry were, as it should be, that the first duty of industrial management (considered as a single corporate body) is to keep the masses in full employment, and the first duty of the Government is to give them all the aid in their power, then surely the best way to give that aid would be by rendering it a little easier for the man who has conceived a business project of *prima facie* usefulness to give sufficiently definite proof that its execution will not result in loss, to get it financed and put it in hand."

The high ethical principle underlying this proposition is undeniable, as also is the immense stimulus that would be given to industrial progress and expansion, if it could be carried into effect, but its application in practice bristles with difficulties arising out of the imperfections of human nature which lie at the root, not only of the abuses of the industrial system, but also of the evils with which our social system abounds.

Mr. Creedy is to be congratulated upon his courage in so fearlessly exposing the trickery and deception often practised in industry and commerce, of which he gives many examples out of his own personal experience, and in showing clearly that the logical outcome of such practices is a demoralisation of the mentality of the business man which necessarily reacts prejudicially upon the commercial standard of morality, and militates seriously against that necessary progress in industry without which the country cannot hope to hold its own in the world struggle for markets for the products of industry.

It must not be thought, however, that Mr. Creedy is wholly academic in the treatment of his subject. His book gives evidence of great practical insight into the economics of industry, and his chapters on the structure and operation of our industrial system constitute an independent study of the psychological aspect of the association of human wills, aspirations and objectives in their relation to the lines upon which the development of the system should proceed in order to lead to permanent economic progress.

Export Office Organisation.

The author elaborates plans for the setting-up of an Export Trade Department. Office organisation, literature, market operations, representatives and their qualifications, and various other points come under discussion.

By GILBERT C. RICH.

IN writing this article I am supposing for the time being that I am starting a new department to deal with the export of a proprietary commodity for a manufacturing company which has not previously exported its products.

The first thing to do is to prepare a special catalogue, setting out in as attractive a manner as possible all the lines to be sold overseas, if necessary stating against each their uses and any special properties or qualities A very important feature of the catalogue is to set forth against each line and size standard case quantities, the number contained in each carton or other mode of packing, ordinary measurements and cubic measurements—both of these should be given in centimetres, and approximate weights of each case should be shown in kilos.

If you issue any booklets or leaflets which give a special description or treatise on any of your lines, a reference should be made in your catalogue against the particular product, such as "For description see page.....of....." One or two coloured illustrations are also a good addition to an export catalogue.

The price-list and terms-sheet should always be on separate sheets, as then the catalogue itself can be used in any market, and if necessary a special price-list or terms-sheet printed at a small cost. This method also saves costs when you are altering your prices.

With regard to the terms-sheet, useful items for this are as follows:—Delivery, trade discounts, cash discount, terms of payment, shipping, cases, packing, execution.

I always consider it advisable to have a sliding scale of trade discounts, increasing as the value of the order goes up, so as to encourage overseas customers to send orders as large as possible, even if you get them less frequently, as it certainly saves time in packing if nothing else, and time is money.

Your terms of delivery can also vary, such as "Ex-works," "Delivered to docks," "F.O.B. British Ports," according to the value of the order.

My experience has taught me that it is a wise move to include the cost of packing and cases in your prices, as this simplifies the merchant's work when calculating a c.i.f. quotation, and the overseas customer also appreciates this consideration if you are dealing direct with him on an f.o.b. basis.

Overseas firms are very keen on prompt delivery when they order, and delay in execution has lost manufacturers many good customers. Therefore a note should appear, under the heading of "execution," to the effect

that orders are dealt with promptly, no avoidable delay being allowed to take place, and where manufacturers are themselves shipping the goods, they will be sent by the first available s.s.

Having prepared your catalogue, the next step is to ascertain in what oversea countries there is a call for the class of goods you manufacture, and attention should also be given at the same time to the vital question of which is the most potential market, as this information will be very necessary at a later period. Too much thought and time should not, however, be given to this side of the question in the first place, as it can be ascertained by degrees, and the information stored till you require it, as mentioned later in this article.

When you know the likely markets, you are in a position easily to ascertain from the "Mercantile Year Book" or other books of reference, which of the home merchants and confirming houses are likely to be interested in your products, but you must not decide that it is useless to attempt to export your goods to a certain country because you have ascertained, during investigations, that such articles have up to the present not been shipped from Great Britain to that country. It is necessary to discover whether such articles are being imported into the territory from any country, and, if not, whether your goods could be usefully imported if the people were educated in their uses.

There should then be prepared what I term a "register of markets," collecting under each market as many details as may be relevant to future transactions with any of these countries, and noting especially the following:—

Area.
Population; and the proportion of whites, &c.
Principal towns and their populations.
The purchasing power of the country.
Rate of duty on such articles as yours.
Consular requirements.
Local conditions affecting your products or their sales.

Statistics of monthly sales may also be usefully included under each country, as this will enable you at any time to ascertain rapidly what progress you are making in a particular market. If your turnover is sufficiently large, graphs may also be prepared to record the progress of each of your lines in various countries. Interesting comparisons can be drawn between the quantities and values of your exports to each country and those mentioned in the official export returns, as by this means you will be able to ascertain what proportion of the total exports you are obtaining and, to some extent, what possibilities exist for your goods in the market in question. Further, your agent can probably ascertain the amounts and values of imports from countries other than Great Britain. Here, again, however, I should like to emphasise the fact that a market may be wholly or partially unexplored as far as your particular goods are concerned.

Having prepared carefully for your efforts, you must proceed to get into communication with the home merchants and confirming house—through the medium of travellers, if you employ them, or alternatively, by means of correspondence and personal visits—bringing to their notice your range of goods, and persuading them, where possible, to introduce them to their overseas clients. They will naturally require supplies of catalogues, price-lists, terms-sheets, any literature you have had printed to advertise your products, and samples. It is most necessary to exercise care in sampling, and decide whether or not samples are likely to lead to business, or ascertain whether the overseas firm is interested in your lines, as a great deal of money can be wasted by the indiscriminate distribution of samples. A very good method to adopt in connection with agents or others who require a large supply of samples for a particular market is to charge for them at listed prices, less 50 per cent. This line of action is also useful in connection with opening orders for a reasonably substantial amount received from buying agents, as the agent then has a margin for introductory expenses.

Another useful adjunct in the export department is the card-index, or indexes, of customers, prospective customers and agents.

Let us deal first with the customers' index. These cards should contain the full name and address of the customers and the agency (if any) which they hold, the markets in which they are interested, and any other useful information, such as credit advisable (if you are dealing direct). Any special correspondence should be summarised on the card, and the date and value of each order recorded as received, as this will enable you quickly to ascertain, from time to time, what progress your customers are making in your goods, and will guide you in the matter of reminders. Letters of reminder should always be made as interesting as possible, and should indicate any points which you may consider of assistance to your customer in his efforts to increase his turnover in your products.

The index for prospective customers has as its object the following-up of possibilities as they arise, and this may be conducted through the medium of an "outstanding queries" file. The best method, if you have to rely upon correspondence, is to get into touch with overseas firms by obtaining lists of all merchants, stores, jobbers, wholesalers and retailers, &c., who are likely to be interested in your products in the countries in question and circularise them, but as the postage on catalogues, booklets, &c., is heavy, and the printed matter itself is too expensive an item to admit of any waste, I always adopt the plan of enclosing with circulars only a small folder, giving details of the various lines, together with a price-list and a sheet of terms, and of mentioning that catalogues, booklets, samples, &c., may be had on application. Lists of this kind can always be obtained through the Federation of British Industries, Department of Overseas Trade, or the London Chamber of Commerce.

It is not necessarily a good point to invite prospective customers to send you an order. This will, of course, depend entirely upon the policy you have decided upon. If you have an agent in the country to which you are sending your circulars, you can mention his name and address in your letter, and state that your goods can be obtained through him. Circularising the trade is not so necessary when you have your own representative visiting the market at regular intervals.

Another important point in connection with an export department is the method of filing, and this may be well sectionalised as follows:—

(*a*) Customers.
(*b*) Active agents.
(*c*) Prospective customers.
(*d*) Shipping, insurance, and general correspondence.
(*e*) Countries.

These headings explain themselves, but I should like to mention that under section (*e*) I have filed everything of interest in connection with the different countries, such as reports or articles on conditions, information received as to consular requirements, duty, &c., together with letters from firms desiring agencies. Thus, when I require an agent for a particular market, I can easily ascertain, by referring to the file, if there is any suitable person amongst the applicants before inquiring elsewhere.

(To be concluded.)

Timber Works Electrification.

Interesting demonstration tests were carried out recently by James Carmichael & Co. (Engineers), Ltd., at their Ward Foundry, Dundee, of the steam turbine plant built by them to the order of Bell & Sime, Ltd., timber merchants, for the complete electrification of their Dundee works. The plant comprises a steam turbine and generator, combined with condensing equipment, for an output of 300 kilowatts. The turbine is of the impulse type, and operates at a normal speed of 8,000 r.p.m., driving the generator at 100 r.p.m. through single-reduction gear; steam is supplied by a water-tube boiler at a pressure of 120 lb. per sq. in.

Protection Systems in Coal Mines.

A Plea for Uniformity.

By E. P. AUSTIN, A.M.I.E.E., A.M.I.Min.E.

WHEN laying out a distribution system in and about a coal mine, the paramount question that an engineer asks himself is this: What method or system of protection will afford the greatest measure of safety without complication or faddism?

The first step is to consult the Regulations made under the Coal Mines Act, 1911, Form 11, August, 1924, in seeking an answer, and there we find that certain broad principles of protection are laid down in Reg. Nos. 128 (*a*), (*b*), (*c*), (*d*), and 131 (*e*). The specific wording with which this subject is immediately concerned is as follows:—128 (*b*) Efficient means suitably placed shall be provided for cutting off all pressure from every part of a system as may be necessary to *prevent danger*.

(*c*) Such efficient means shall be provided in respect of each separate circuit for cutting off all pressure automatically from the circuit or part or parts of the circuit affected in the event of a fault as may be necessary to *prevent danger*.

131 (*e*) Should there be a fault in any circuit, the part affected shall be made dead without delay and shall remain so until the fault has been remedied.

There is nothing in these words to indicate what system should be employed, but emphasis is laid on the prevention of danger. Further light is given on the subject in the memorandum to Reg. 128 (*c*), where it is quite clearly stated that leakage, in addition to overload, protection is favoured by the Mines Department.

It is evident that the requirements can be met by installing the simplest form of overload protective gear in the form of thermal cutouts, suitably constructed and housed, but no one would contend that this was good practice in all circumstances.

Considering the most general practice of the three-phase circuit, it is common knowledge that protective devices of a highly efficient character can be used to afford the highest protection to apparatus, and render the liability to shock very remote by cutting out a faulty circuit automatically in the early stages: Thus in the wording of the rules, they *prevent danger*.

It seems to the writer that the time is ripe for a clear official definition to be given of the protective system that should be adopted with each class of circuit.

Colliery systems are usually self-contained, and the application of a given system is therefore simplified.

A study of the report of the Electrical Inspector of Mines shows a marked divergence of practice in using the earthed or unearthed neutral, but it does not appear that the danger in case of shock on medium- and high-pressure systems is greatly affected by earthing the neutral. It seems perfectly clear that danger from other causes is greatly reduced by earthing the neutral, provided that a system of leakage protection is used, but the absence of such devices may lead to certain conditions more dangerous than can occur with an insulated neutral.

This may be the case with a fault to earth on a remote (electrically) part of a system, resulting in sustained open sparking, particularly if thermal cutouts are employed and are improperly graded.

It has been proved, both by experiment and in practice, that a fault between two cores of a three-core cable may be cleared by sensitive balanced protective gear without damaging the neighbouring core or giving rise to open sparking.

Overhead protection alone means taking the risk of damaging the outer insulation, and arcing to the armouring, which, of course, is "open sparking." This point is particularly important where trailing cables are used at the coal face.

It seems evident that an earthed neutral should be used in conjunction with leakage protection and balanced apparatus on all feeders and sub-feeders. The advantages may be summarised as: Limitation of the duration of a fault; reduced voltage of a fault to earth.

An earth fault or partial "short" will be cut off before open sparking occurs or any person receives a shock.

If C.T.'s and relays are used, there should be one on each phase operating a separate relay.

Three-phase relays should not be used which have one common moving element.

The characteristics of the many methods of leakage and balanced protection have been discussed by many able writers, such as Wedmore, Clothier, &c., to whose work reference should be made.

The principles enumerated here exclude the use of fuses. The writer is of opinion that three-phase motors should not be protected by fuses; cases have happened when only one fuse has blown and left the motor running on two phases, resulting in a roast-out and evolving sufficient stench and smoke to cause a small panic.

Another great disadvantage with fuse gear is the necessity of opening the case for the renewal of fuses, perhaps by an unauthorised person who may put in any fuse that may be handy, and may neglect to replace all the holding-down bolts in his anxiety to get the machinery going again. There are instances of serious accidents arising from these causes.

In addition to the switchgear being of sufficient size to carry the currents required, it should be able to clear a dead short-circuit without damage. Reg. No. 124 (*a*).

Other important points are the type and method of connection of the C.T.'s.

With certain types and secondary connections it is possible for currents largely in excess of the settings to flow before the switch opens.

The reasons for this are various, and include the magnetic characteristics of C.T.'s and phase relationships between fault currents and secondary currents. Reference should be made to standard literature on switchgear.

In brief, all three-phase switches should be fitted with three overload coils or the equivalent. The question of using a limiting resistance in the neutral to earth circuit has not been definitely settled. It seems undesirable, as it is possible for the armouring of cables to rise to a dangerous potential, and the size of a colliery plant is usually small enough to do without it. On a large system the matter may be dealt with in other ways.

Mature consideration leads to the following conclusion:—

Neutral points should be dead earthed. Leakage and overload protection should be used on each main feeder and sub-feeder. Pumps and large haulages should have separate feeders so that faults on distribution cables would not affect these important units.

Fuses should be used only on single-phase low-pressure circuits not exceeding 5 kVA capacity.

The position of switches on various parts of a system might be specified more definitely than at present in Reg. 128 (*b*). The maximum length of a feeder between non-automatic switch points might be specified.

Greater safety below ground would result if the existing rules were supplemented on the lines indicated, so that there would be a certain standard for every mine.

It may be argued that such arrangements would be too costly to adopt in all cases, but it is not possible to make a good job below ground without incurring expense. Safety warrants the best possible job being put in; where this is done, electricity is the safest form of power to use.

The Trade Paper.

A Mine of Valuable Information which is only Partially Exploited.

[Communicated.]

BY most successful business men, their trade paper is read each week from cover to cover, but in spite of the immense amount of up-to-date and valuable information to be obtained from this source, there are still many establishments where little or no attempt is made to utilise to the fullest extent the service it is capable of rendering. One of the most common failings in this direction is for the trade paper to be regarded as the personal perquisite of a particular person or department. In one place, it may be commandeered by the managing director, in another it is seldom or never permitted to get beyond the confines of the advertising department, while in another the paper is appropriated for the exclusive information of designers or drawing-office staff. Fortunately this state of things is not so common as it used to be, and in most up-to-date establishments there is evidence of a more or less successful attempt to circulate the paper to the principal departmental heads; but it is here that a laudable practice is apt to fail through the attempt to make a single copy serve the purpose of three or four. Many instances are to be found of a trade paper circulating to the staff of a concern, inscribed with eight to ten names on the cover. Through unforeseen delays resulting either from pressure of work, or it may be the delay in reading through a specially important issue, it is seldom possible for those on the list beyond the second or third to have more than a very remote idea when they are likely to see a particular number. For three or four weeks they may be kept without the current news of the trade in this way, and then receive a surfeit in the shape of a month's supply on the same day!

The value of the trade paper is far from being adequately appreciated in this country. Even single subscriptions are occasionally apt to be regarded with suspicion in a time of severe retrenchment, whereas if there are a dozen persons on the staff whose efficiency would be improved by being kept in touch with current events in the trade, there is room for three or four copies to be subscribed for. The contents of a trade journal are so valuable as to make its regular and diligent study both a necessary and a profitable duty, but this cannot be done to a strict time-table. A technical article on design, for instance, may require prolonged study and comparison, and its conclusions and figures may have to be noted and compared with others, all of which makes it difficult to arrange beforehand a fixed schedule for reading.

The Contents.—It is only the regular reader who begins to appreciate fully the mine of technical and commercial information obtainable from the pages of a good trade paper; a casual or occasional reader is apt to miss much of the value. From its pages can first of all be obtained information upon design and current practice which is far more up-to-date than any of the ordinary works of reference, and in many cases in advance of the makers' own catalogues. On many occasions a reprint from a trade paper descriptive of some new development has been used both by the maker concerned and by dealers to serve as publicity literature pending the preparation of a catalogue. In its columns are to be found regular and up-to-date information respecting both exports and imports of the goods in which the reader is interested, in a form which for promptitude and classification makes the official Customs Returns, which are not usually obtainable until eleven months after the conclusion of any year, appear merely like historical records in comparison! Many of the export and import records thus obtainable would cost a couple of guineas if purchased from official quarters.

The business and financial news gives information of another nature. From the notes in the columns dealing with debenture issues, mortgages, and other charges the first hint is often obtainable of a change in the financial standing of a buyer which would otherwise be entirely unsuspected. From the reports of company liquidations, if properly studied, one may obtain information upon current commercial practice in the trade in the way of overhead charges, selling expenses, turnover-capital ratio, and wage-output ratio such as no individual personal experience could supply, as all such details are usually the well-guarded secrets of the private ledger.

The advertising columns are no less valuable than the editorial pages. They give early intimation of changes in design, new sources of supply, and indications of a competitor's future policy. Thanks to the increasing attention which is now being paid to the purely commercial side of business, it is even possible to conduct a complete advertising campaign from the detailed schemes dealing with the subject which are published periodically.

Procedure.—For the best use to be made of the information available from week to week, a regular routine is necessary. A single copy should not have to circulate to more than three or four persons, but this desideratum should be attained not by limiting the number of persons who are allowed to read the paper, but by increasing the number of copies taken. One copy must obviously be filed week by week intact; other copies would then be available for the purpose of taking cuttings of any specially useful articles, but cuttings should not be permitted until the paper has finished the round of names indicated on the front cover, and when this has been done it is advisable to indicate that the copy is then an incomplete one by cutting off the top right-hand corner of the cover or by some similar indication.

Nearly all papers publish an index, but this is not available until the end of the half-year, and in a business where full use is being made of its trade organ, the latter will undoubtedly have to be referred to many dozen times before the index is issued. The writer has found it a good plan to note on the front page of the filing copy a reference to any specially useful item contained in the issue to which it is probable that reference will have to be made again at a later date, so as to minimise the loss of time looking through back copies.

Compared with its possibilities, the cost of the trade paper is negligible. From a single number one may obtain a hint which may save a bad debt of hundreds of pounds, or an explanation of a new development which may mean all the difference between stagnation and progress. If properly used, the trade paper subscription is the most profitable investment in modern industry.

Paper.....

Note items marked on pages.	Name.	Date received.	Date passed on.
	Mr. A. Brown		
8, 12	Mr. B. Jones		
	Mr C. Robinson		
4, 20	Mr D. Smith		

An indication on the lines of the above affixed to the front cover will facilitate both the proper circulation and the reading of a journal.

Legal.

An Electrical Engineer's Petition.

A PETITION by Mr. Robert F. Parry, electrical engineer, Liverpool, for the compulsory winding-up of Thurstaston Hall Convalescent Home, Ltd., West Kirby, Wirral, came before Mr. Justice Romer in the Companies Winding-Up Court on December 13th, and was not opposed.

Mr. W. F. SWORDS, for the petitioner, said that the company was formed by a Mr. Arthur Carson, who, representing himself as a relative of Lord Carson, worked on the sympathies of the benevolent public in the neighbourhood of Liverpool, obtained money, took a seven-year lease of Thurstaston Hall, an old mansion, furnished it entirely on credit, engaged a staff, and then vanished.

The petitioner was a creditor for £357 9s. 7d. He was induced to install all the electrical fittings at the Hall. Service on the company could not be effected as the registered office in Victoria Street, London, had been closed, and Carson could not be found. Substituted service was, however, effected on a Mr. Arthur O'Leary.

His LORDSHIP made the order asked for.

Wrongful Use of the Term "Registered Contractors."

IN the Chancery Division on December 14th, Mr. Justice Romer heard a motion by the National Register of Electrical Installation Contractors against the Endwell Electric Co., Ltd., for an injunction restraining it from representing itself as holding a certificate of registration, and from using the Association's mark on its business stationery or otherwise in such a way as to lead to the belief that the defendant company was on the National Register.

Mr. TOOKEY, for the Register, said that one of its primary objects was to keep a register of installation contractors who had given satisfactory evidence of their competency and responsibility in their business. For the purpose of distinguishing the contractors on the register there was a mark which registered members were allowed to use. If this was used by any contractor on his papers it indicated that his responsibility and competency were vouched for by the Register. The defendant company was not registered but had used words which at any rate were a colourable imitation of those which registered contractors were entitled to use. After these proceedings were started the defendant company had gone into voluntary liquidation. They had been in communication with the liquidator, who consented to an order on behalf of the defendant company. He had signed a form of consent. There was no appearance for the defendant company.

His LORDSHIP thereupon granted the injunction in the terms of the motion.

Compensation for Electrical Injuries.

IN the Court of Session, Edinburgh, recently, a settlement was announced in the action by Matthew Lynch, against the United Collieries, Ltd., Glasgow, claiming £1,000 damages for personal injuries. The plaintiff, in January last, was walking in a field through which run overhead h.p. lines between two collieries belonging to the respondents. Near one of the poles which supported the cables the plaintiff inadvertently touched a projecting portion of a wire intended to act as a lightning conductor. He received a shock, his right hand was badly burned, and he was detained in hospital for twelve weeks. The lightning conductor, he said, had become rusted and broken, and one of the cables had become detached from the insulator.

The action was settled by the payment of £150 and expenses.

Commissioners of Inland Revenue v. British Insulated Cables, Ltd.

IN the King's Bench Division on December 14th, Mr. Justice Rowlatt had before him an appeal by the Commissioners of Inland Revenue from a decision of the Commissioners for the Special Purposes of the Income Tax Acts discharging assessments to Corporation Profits Tax made upon the British Insulated Cables, Ltd.

Opening the appeal, Mr. R. P. HILLS, Junior Counsel to the Inland Revenue Department, said that the Company carried on the business of manufacturers of cables, wires and all electrical apparatus and also the business of an electric light company in all its branches. There was installed at the company's works at Prescot an electricity generating plant with the primary object of supplying the works with electricity. Later the company obtained Orders which empowered it to supply electrical energy in certain districts within four miles of its works. The assessments to Corporation Profits Tax were for the accounting periods between January, 1920, and June, 1924, and for the year 1920 the Commissioners found that the total sales of electricity amounted to £50,013, of which £8,166 represented sales to outside consumers and £41,847 sales to the company's own works. In the year 1920 the total sales (other than those mentioned) were £5,398,471. In the same year the approximate number of persons employed was 7,000, of whom 45 were employed in connection with the company's electricity undertaking.

The Commissioners found that the company's electricity undertaking was not constituted as a separate entity with distinct capital, nor was any distinction drawn in the company's annual accounts between its electricity undertaking and the manufacturing and engineering business.

It was contended on behalf of the company that the company carried on wholly in the United Kingdom an electricity undertaking and that as it was precluded by statute from charging any higher prices for electrical energy than the prices authorised by Acts of Parliament, the profits of the company were exempted from Corporation Profits Tax by virtue of Section 52 (2) i of the Finance Act, 1920.

The Crown contended before the Commissioners that the company was liable to assessment, and alternatively, if the company was entitled to exemption granted by Section 52, the exemption extended only to the profits derived from the electricity undertaking. The Commissioners decided in favour of the company and discharged the assessments.

After hearing arguments by Mr. R. P. Hills for the Crown and Mr. A. M. Latter, K.C., for the company, his LORDSHIP, giving judgment, said that the exemption clearly applied to a company which carried on any electricity undertaking and was restricted by Act of Parliament in the matter of prices to be charged and dividends paid. In that case two possible positions were open to the Crown. First, it could be said that the company must be looked at as a whole and that it was not a company carrying on an electricity undertaking because the undertaking was a small part of its property; or, secondly, that the company must be treated as divided into two businesses. The latter point, however, had not been argued, although it was understood the point was made and might be determined on a future occasion after the decision in another case which was to go before the House of Lords. Regarding the first point two cases had been decided by his Lordship. In the Ryde Pier case, where the company had a pier with a tramway upon it, he held that the fact that the company carried on the tramway business exempted the company as a whole from Corporation Profits Tax. The other case was that of the Birmingham District Traction and Power Company, which went to the Court of Appeal. In that case the company had subsidiary companies which were not within the exemption section and were taxed together by virtue of section 53 (3) of the Finance Act, 1920, and the argument was whether the subsidiary undertakings were taxable or not. His Lordship decided in favour of the Crown but the Court of Appeal held that, treated as one company, the Birmingham Company, with its subsidiary companies, did carry on as part of its activities an exempted undertaking. One of the appeal judges accepted his Lordship's judgment in the Ryde Pier case by saying: "If you have a company which did among other things carry on one of these businesses mentioned in Section 52 (2) i, that fact exempted the whole company." That decision and the decision in the Ryde case seemed to be applicable to the present case. It was an odd result, but the explanation was to be found in the fact that those who drafted that particular section of the Finance Act overlooked the fact that a company could carry on more than one business; the section as worded clearly exempted a company because it carried on, among other businesses, an exempted undertaking. For those reasons the appeal would be dismissed with costs.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Special Orders.

Special Orders have been approved relating to part of the urban district of Fleet and parts of the rural districts of Basingstoke and Hartley Wintney, Southampton, and parts of the rural districts of Guildford and Hambledon Surrey; the urban district of Tarporley and parts of the rural district of Tarvin, Chester, and for the amendment of the Chester Electricity Orders, 1890 and 1923; part of the rural district of Penybont, Glamorgan; the rural district of Gloucester; the urban district of Criccieth, Carnarvon; parts of the rural districts of Darlington, Hartlepool, Sedgefield, and Stockton, Durham; the parish of Bourton-on-the-Water, in the rural district of Stow-on-the-Wold, Gloucester; the parish of Headley, in the rural district of Epsom, Surrey, and for the amendment of the Leatherhead and District Electricity Orders, 1902 to 1925; the borough of New Windsor, Perks., and the urban district of Eton, Buckingham; and in respect of the purchase and use by the West Midlands Joint Electricity Authority of land for a generating station at Buildwas, Salop.

Oil from Coal.

On December 12th Mr. DAY asked whether it was intended to publish the results of the investigations that had been made at the fuel research station on the Bergius process for the extraction of oil from coal; and whether any and, if so, which English systems for the foregoing purpose had been investigated.

The DUCHESS OF ATHOLL said that the question of publication of the results hitherto obtained at the Fuel Research Station, Greenwich, was now under consideration, but it was probable that publication would be delayed until the investigations had been further advanced. No English process for the conversion

of coal into oil by hydrogenation had been brought to the notice of the Fuel Research Board. As regarded low temperature carbonisation, besides the work undertaken at the Fuel Research Station, investigations had been conducted into, and reports had been published on, the following English processes:—The "Parker" plant at Barugh; the Midland Coal Products, Ltd., plant at Netherfield; the "Fusion" rotary retort; the "Freeman" multiple retort of the British Oil and Fuel Conservation, Ltd.; and the "Crozier" retort. The report on the last mentioned was now being printed.

Electricity Prices in London.

On December 13th Sir HENRY JACKSON asked the Minister of Transport whether he was aware of the growing dissatisfaction of electricity consumers in the Metropolis in consequence of the delay which was taking place in carrying out the provisions of the Third Schedule to the London Electricity (No. 1) Act, 1925, which (*inter alia*) enacted that the dividends of electric lighting companies operating in London should be regulated in accordance with a sliding scale of prices and dividends; and whether he could give an approximate date when the settlement of the details of the sliding scales might be expected.

Colonel ASHLEY said that it fell primarily to the London County Council to approve the standard prices for the purpose of regulating the dividends payable by the companies. Before, however, this could be done, it was necessary for a settlement to be reached upon certain matters between the companies, the London and Home Counties Joint Electricity Authority and the London County Council. He understood that prolonged negotiations between the parties had taken place, but that the stage had not yet been reached at which the matter could be finally determined.

Electricity Act Loans.

Sir JOHN POWER asked when the first loan would be raised under the Electricity (Supply) Act; and what amount it was then proposed to raise.

Colonel ASHLEY said that the matter was one for the Central Electricity Board, and he was not in a position to make any statement.

The South-Eastern Electricity Scheme.

On December 13th Mr. THURTLE asked the Minister of Transport if he was aware that the Shoreditch Borough Council anticipated that the South-East England electricity scheme would involve a loss to consumers in the borough of £33,700 a year, instead of the saving of £20,600 estimated by the Electricity Commissioners; and whether he proposed to ask the Central Electricity Board to hold a public inquiry before approving the scheme.

Mr. GROVES asked the Minister if he was aware that the estimated saving of £90,276 to West Ham under the South-East England electricity scheme was regarded as quite illusory by the Corporation which estimated that a loss to its consumers of £153,368 in the next five years would result from the application of the scheme in its present form; and if he would refer the matter to the Central Electricity Board to hold a public inquiry.

Colonel ASHLEY said he was informed by the Central Electricity Board that all representations made to it to the effect that the savings estimated in connection with the South-East England Electricity Scheme were not likely to be realised would be carefully considered before the scheme was adopted.

On December 13th Mr. GROVES asked the Minister if he could account for the fact that the Electricity Commissioners estimated a saving of only £90,276 to West Ham under the South-East England scheme, while the City of London Electric Lighting Co. was estimated to save £825,182 on a smaller quantity of electricity consumed; and why, in view of the greater efficiency of the West Ham station, it was proposed to reduce the output of that station from 100 million kWh per annum to 5¼ million kWh and thus throw idle a large quantity of up-to-date and efficient plant.

Colonel ASHLEY said the saving which the Commissioners estimated would result to a particular undertaker depended on the estimated cost of the supply from the Board as compared with continued independent operation. These matters were at present the subject of representations to the Central Electricity Board. The use to which a selected station would be put in the production of electricity for the Board would depend upon the operation of the scheme by the Board and would be adjusted so as to secure the most economical use of the stations as a whole.

On December 13th Mr. BARNES asked whether the estimates of cost prepared by the Electricity Commissioners in connection with the South-East England electricity scheme included any allowance for the compensation which would be payable for loss of office to staffs dismissed as a result of the closing down of generating stations.

Colonel ASHLEY said he understood that, although, as in the case of the scheme for Central Scotland, the estimates did not show as a separate item any allowance for this purpose, the Commissioners were satisfied that there was sufficient margin in the estimates on which the savings were based to cover any payments which might have had to be made.

On December 15th Mr. BARNES asked the Minister of Transport whether he was aware that a large number of municipal authorised undertakers maintained that Clause 5 of the South-East England electricity scheme was *ultra vires*, on the ground that the 1926 Act gave no power to the Central Electricity Board to lay down in the scheme the precise terms on which electricity should be paid for under temporary arrangements; and whether he would refer this matter to the Board for inquiry.

Colonel ASHLEY said he understood that representations on the point had already been received by the Central Electricity Board and were at present under consideration.

Beam Wireless.

On December 13th, Sir W. MITCHELL-THOMSON, Postmaster-General, informed Mr. O. Nicholson that the following rates per word were charged for full-rate traffic by the beam wireless services and the cable services respectively:—India, beam 1s. 1d., cable 1s. 5d.; Australia, 1s. 8d. and 2s.; South Africa, 1s. 4d. and 1s. 8d.; Canada (Eastern Provinces), 9d. and 9d.

The Holborn Telephone Exchange.

On December 13th Sir W. MITCHELL-THOMSON informed Mr. Day that he was not aware that the difficulties encountered with the new Holborn automatic exchange were greater than were inevitable with so complete a change in mechanism and methods of operation; and practical experience had not brought to light any serious defects in the apparatus. In order to ensure the best possible results, special attention was being given to the maintenance of all plant concerned and to the operating procedure of the staff and of subscribers.

The Electricity Commission.

On December 15th Sir D. NEWTON asked the Minister of Transport if he was prepared to arrange that a representative of rural interests be appointed to the Electricity Commission.

Colonel ASHLEY considered that it would not be desirable to appoint representatives of particular interests, however important, though he was in complete sympathy with the desire that rural interests should be borne in mind in connection with electricity schemes.

Agriculture and Electricity.

On December 15th Sir M. MANNINGHAM-BULLER asked the Minister of Agriculture whether he would consider organising lectures in agricultural centres on the use and application of electricity to farming.

Mr. GUINNESS said he was not satisfied that the time was yet ripe for the measures suggested, but he would consider the question again when he had received the report of the conference recently convened by the Electricity Commissioners to consider the whole question of rural electrification.

Wayleave Rentals.

On December 16th Major GLYN asked the Minister of Transport if he could state what were the wayleave rentals recently awarded in various counties for the construction of lines under the Electricity (Supply) Act, 1926; whether the prices of 4s. a pole for arable land, 2s. for grass land, 1s. for other land, and 6d. for stays will be taken as an indication of the prime costs of line construction; and how did such prices compare with the estimates made when the Electricity Act was being framed.

Colonel ASHLEY said that wayleave rentals in connection with electricity lines necessarily depended to some extent on the circumstances of each particular case, but the figures mentioned corresponded with or closely approximated to the rentals that had been recently awarded in various parts of the country. Any estimates that might have been made of wayleave expenses in connection with main transmission lines would, in view of the different type of supports required, not be comparable with the figures referred to.

A Swedish Electric Lorry.

The Swedish General Electric Co. (Asea), of Vesteras, Sweden, has recently introduced an electric truck for loads of from 2 to 2½ tons. The vehicle has a wheelbase of 9 ft. 11 in. and a track of 4 ft. 9 in. It is equipped with a battery having a capacity, with full load, of from 34 to 37½ miles on one charge. The steel disk wheels are fitted with 30 by 5-in. pneumatic tires, twins being used at the rear.

A Magnetic Nail Collector.

A New York correspondent of *The Times Trade and Engineering Supplement* describes a method which has been developed in the United States for collecting nails and other metal articles upon roads, which are a prolific source of tire punctures. It involves the use of a magnetic nail picker. The magnets, which are the essential part of the device, are in 4-foot sections, one, two or three sections being used according to the width and roughness of the road to be treated. The magnet is a wire-wound bar laid in one side of an I beam, the open side being covered with a brass protecting plate. The I beam sections are suspended just in front of the rear wheels of a two- or three-ton truck, and are thus taken over the road. The truck carries a 3-kW, 110-V, d.c. generator, driven by a Ford engine, to energise the magnets.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

The E.D.A. Circle Campaign.

From all oyer the country the organisers have received glowing reports of the results of the extra effort put forward during National Electric Week. Practically all the Centres have made increased sales as compared with previous years and a considerable stimulus has been given to Christmas trade in electrical appliances.

Another "all-electric" house was opened for demonstration purposes at Birmingham on December 5th, and it will be available for inspection during the next few weeks. It is situated on the main Warwick Road at Solihull, a rapidly growing residential area served by the Electric Supply Department, a few miles from the southern city boundary. The house is arousing a good deal of local interest, and is also being visited by large numbers of residents from adjoining villages, and reflects great credit on the activities of the local Circle under whose auspices the demonstration has been organised. An excellent selection of electric lighting fittings and shades, including candelabra, table and floor standards, &c., have been installed, and the electrical apparatus includes a cooker, water heater, washer, refrigerator, hotplates, kettles, irons, vacuum cleaners, coffee percolator, various types of fires, sewing machine, electric piano player, towel rail, shaving mirror and reflector, vibro-massage, curling irons, and other small appliances.

A dance organised by the sub-committee of the Leeds Circle in connection with National Electric Week, was held in the Scala Ballroom, Leeds, on December 9th, and was attended by 205 people, representative of electrical manufacturers, factors, and contractors, and their friends in the district. Fancy dress was optional, and thanks to the good response to the appeal of the committee, 35 electrical prizes were generously given, and presented to the winners of the fancy dress, spot, and novelty dances, and whist drive. Although the dance was organised in a little over a fortnight a most enjoyable evening was spent, and many requests have already been made for another electrical dance in the New Year.

An electrical demonstration house at Gourock is attracting much attention, over 400 people inspecting it in one day. The electrical fittings were provided by the Greenock Circle and the house was furnished by the Greenock Central Co-operative Society.

New Showrooms.

On December 5th Major the Hon. Eric Long, M.P., formally opened new showrooms at Melksham, arranged by the West Wilts Electric Light & Power Co., Ltd. The showroom front has been carried out in bronze, and, as will appear

New Showrooms at Melksham.

from the illustration herewith, during National Electric Week, when the photograph was taken, the company displayed the special window "fit-up" designed by the British Electrical Development Association. The suspended board in the centre of the window top announces "Electricity by Annual Subscription." This has reference to the two-part tariff employed by the company, consisting of a standing charge based on the number of rooms and a "unit" charge which falls after the consumption of a certain quantity of energy. At present the load is mainly lighting, but the company is doing a great deal of educative work to encourage the use of electricity for other domestic purposes. A bulk supply is received from Bath and distributed in Chippenham, Devizes, Malmesbury, Melksham, Trowbridge, Warminster, &c.

Illuminated Elephants at South Kensington.

The accompanying illustration shows a group of three immature elephants at the Natural History Museum, South Kensington, in a reproduction of their native jungle composed of

A Jungle Scene at the Natural History Museum.

actual grasses, trees, and foliage imported for the purpose. The scene was designed and the scenery painted by Captain J. G. Dollman, and the whole of the work was carried out under his supervision. The provision of suitable lighting for the group was entrusted to Dr. G. F. Herbert Smith, who, in conjunction with the Illuminating Engineering Department of the General Electric Co., Ltd., designed a lighting scheme to incorporate changes ranging from brilliant sunshine to moonlight. The effects are wonderfully realistic and it is difficult to remember that the animals are not alive. "Gecoray" reflectors equipped with "Osram" gasfilled lamps and suitable screens are used to produce these effects Dr. Herbert Smith has also designed a most effective internal structure which is so built in, that the walls are not interfered with in any way, and the whole of the equipment can be reached for relamping, or manœuvring required scenes, without the slightest difficulty.

Recent Contracts.

A multi-exchange area of five automatic exchanges at Pernambuco has been completed by Messrs. Siemens Brothers & Co., Ltd., and was brought into service on December 3rd. The new exchanges are: Sao Jose (800 lines initial, 3,000 lines ultimate); Boavista (800 lines initial, 3,000 lines ultimate); Recife (400 lines, initial, 1,000 lines ultimate); Capunga (400 lines initial, 1,000 lines ultimate); Olinda (100 lines initial, 200 lines ultimate). The first three are main exchanges, the other two being satellites of Boavista. The automatic equipments, which provide a full automatic service for the area, are the company's "No. 16" type. The company also supplied the new automatic telephones and private branch exchange switchboards required for the subscribers, all of the apparatus being specially treated to withstand tropical climatic conditions.

Australian Tariff on Domestic Appliances.

The Electrical Federation of Victoria recently applied to the Commonwealth Tariff Board for the remission of import duties upon British electric washing machines, dish washers, floor polishers, fans and hair dryers, and the reduction of the duty on such apparatus of foreign manufacture to 10 per cent. At a subsequent inquiry Mr. W. Richards, the general manager of the Federation, said that some of these appliances were not made in Australia, and would not be made until a market had been created by imported appliances. He pointed out that when the duty on vacuum cleaners was abolished the price immediately fell to a level at which every housewife could buy them. There was opposition to the application by one firm which, it was alleged, made domestic washing machines, and the inquiry was adjourned.

Book Notices.

"The *Ironmonger* Diary and Hardware Buyers' Guide, 1928." (688 pp. and diary.) London: *The Ironmonger*. Free to subscribers.—This is a comprehensive directory of the hardware and allied manufacturing industries. It contains a classified section, trade mark indexes (alphabetical and classified), particulars of wrought iron tubes and fittings, information regarding wire netting, analyses of foundry pig irons, a number of useful tables, and much other information.

"Leeds Church Middle Class School." By E. Kilburn Scott, M.I.E.E. Pp. 75; illustrated. Leeds: Edwin Jowett, Ltd. Price 2s. 3d., post free.—This book is the outcome of considerable correspondence from pupils following an article written about the School for the *Yorkshire Weekly Post* in 1922, and contains much matter of interest to "old boys." This was one of the first schools in the country to make adequate provision for science teaching.

"The Wireless Trader Year Book and Diary." London: Trader Publishing Co., Ltd. Price 5s. net.—The 1928 edition of this useful book marks the fourth successive year of its issue. In the main, it covers the same ground as previous volumes; although it has been found necessary to delete some of the matter hitherto contained in it, its size remains as before, and revisions and additions will add to its value as a whole.

"*Journal* of the Institution of Electrical Engineers."—Vol. LXVI. December, 1927. London: E. & F. N. Spon, Ltd. Price 10s. 6d.

"Technical Drawing," by G. E. Draycott. Pp. viii+232; figs. 285. London: Humphry Milford, Oxford University Press. Price 6s. net.

Trade Announcements.

Mr. GEORGE E. PINCH has added new showrooms to his wireless and sports depôt at 2, Albert Road, Devonport.

Messrs. BARRATT BROS., electrical and wireless engineers, have opened new premises at 30, Baxtergate, Whitby.

Mr. A. H. START, electrical and general engineer, whose premises in Church Street, Sidmouth, were recently destroyed by fire, is shortly re-opening business at the Marine Garage, Sidmouth.

THE ELECTRO-MECHANICAL BRAKE CO., LTD., THE AIREDALE ELECTRICAL & MANUFACTURING CO., LTD., and MESSRS. ARCHIBALD LOW & SONS, LTD., have transferred their London office address from Norfolk Street, Strand, to Cecil Chambers, 86, Strand, W.C.2.

JURY'S ELECTRIC SERVICE, LTD., have opened new premises at 87, Little Park Street, Coventry.

Messrs. H. W. TEETON, LTD., have opened new electrical and wireless showrooms at 23, Greengate Street, Stafford.

New Catalogues and Lists.

SILVERTOWN LUBRICANTS, LTD., West Silvertown, E.16.—A booklet illustrating applications of "Emulsil" cutting oil.

THE WHOLESALE FITTINGS CO., LTD., 23, 25, 27 and 37, Commercial Street, E.1.—Catalogue No. E.210, containing fully-illustrated particulars and prices of lampholders, adaptors, switches, plugs and sockets, time switches, conduits, lighting fittings, and other electrical materials and accessories.

LIGHTING TRADES, LTD. (incorporating J. & W. B. Smith, Ltd.), 30-31, Farringdon Street, E.C.4.—An illustrated and priced catalogue of "Redot" electric fires of many patterns.

MESSRS. S. G. BROWN, LTD., North Acton.—The "Brown Budget" for December, containing illustrated notes on the company's business.

THE BENJAMIN ELECTRIC, LTD., Brantwood Works, Tariff Road, Tottenham, N.17.—The "Benjamin Reflector" for December, dealing with industrial lighting, the "Majestic" h.t. battery eliminator, &c.

Bankruptcy Proceedings.

LOUIS SAMUEL, wireless accessories dealer, late of 54, Gracechurch Street, E.C.—This debtor attended before Mr. Registrar Mellor at the London Bankruptcy Court on December 13th, for public examination upon accounts showing liabilities of £1,875 and assets valued at £1,500. Replying to Mr. Armstrong, Assistant Official Receiver, the debtor stated that a previous failure was recorded against him in 1920, from which proceedings he was discharged in January, 1922. In October, 1926, he purchased for £200 the business of a wireless accessories dealer carried on under the style of "Smarts Stores." With a borrowed capital of £25 he commenced to trade there, obtaining additional stock on credit. Later he registered Louis Samuel, Ltd., with a nominal capital of £500, to acquire the business for £466, which, however, was never paid. A debenture for £100 was issued to his father on February 28th, 1927, in respect of cash advanced; the business had by then been removed to 130, Leman Street, E. The company passed a resolution for liquidation on March 3rd, and three weeks later his father, as debenture holder, appointed a Receiver, who realised the assets and paid £100 to the father in respect of the debenture and the costs of the receivership and liquidation. The debtor attributed his failure and insolvency to the fact that he did not receive any cash consideration on the transfer of his stock to Louis Samuel, Ltd., and was therefore unable to discharge his debts. He admitted that when the debenture for £100 was given to his father he had no means of paying off the trade debts. The examination was concluded.

T. W. DOUST, electrical engineer, &c., Shamrock House, Ramsgate, Louth, late of Mablethorpe.—First meeting held December 20th at the Official Receiver's office, St. Mary's Chambers, Great Grimsby. Public examination, January 5th, at the Town Hall, Great Grimsby.

P. W. WITHAM, electrical engineer, 139, Bournemouth Road, Parkstone.—Trustee, Mr. F. G. Wheatley, 102, High Street, Poole, appointed December 7th.

A. M. EDWARDS (Mansell, Edwards & Co.), electrical engineer, High Street, Blackwood, Mon.—Receiving order made December 7th, on debtor's own petition. First meeting held December 22nd, at Park Place, Cardiff. Public examination, January 19th, at the Town Hall, Tredegar.

S. B. MARSHALL (Pytram Mfg. Co.), Pytram Works, Dunbar Road, New Malden.—Bankrupt's discharge granted subject to judgment for £400.

A. L. WEEKES, electrical engineer, 13, Crescent Road, Luton.—Bankrupt's discharge granted subject to judgment for £100 and 30s. costs.

J. H. DOLLITTLE (Zenith Radio Mfg. Co.), wireless engineer, Virginia House, Portsmouth Road, and 17, Park Street, Guildford.—Trustee, Mr. T. Gourlay, Official Receiver, 29, Russell Square, W.C., released December 5th.

A. H. SMITH, electrical distributor, 3, Park Place, Cardiff.—Last day for proofs for dividend, January 3rd. Trustee, Mr. E. Owen, Official Receiver, 34, Park Place, Cardiff.

H. B. POWELL, wireless dealer, 10, Union Street, Hereford.—First dividend of 3s. 6d. in the £, payable December 29th, at 2, Offa Street, Hereford.

Company Liquidations.

ENDWELL ELECTRIC CO., LTD., Ardon House, Endwell Road, Bexhill-on-Sea, electrical contractors.—A meeting of creditors was held on December 14th, Mr. K. H. Michell, liquidator, presiding. A statement of affairs was presented which disclosed liabilities of £2,326, of which £765 was due to the trade, and there were loan creditors amounting to £775. The liquidator explained that when he was appointed the Sheriff was in possession, and in order to protect the assets he was paid out the sum of £133. The bank was an unsecured creditor for £786, but it held the personal guarantee of two of the directors up to £650. The net assets were £388, leaving a deficiency of £1,938. The company was incorporated on October 19th, 1926, and the issued capital was £1,407 in shares of £1 each. It took over a business which had been carried on by a Mr. Trevor Roper. From accounts made up to August 31st this year the total turnover was £2,300, and practically no gross profit was made. The overhead expenses were very heavy, and consequently there was a considerable loss. The liquidator said that he had hopes of selling the business as a going concern, at a reasonable price, in which case the creditors should receive a fairly satisfactory dividend. There were several contracts on hand, and also a number of estimates had been given in the districts around Hastings and Wye; it might be advantageous to the creditors if the contracts were completed. It was decided that Mr. E. H. Hawkins should be appointed joint liquidator with Mr. Michell, together with a committee of inspection consisting of three of the creditors. The following are creditors:—

	£		£
Wanklyn, H. T.	425	Bexhill Motors	43
Jackson, C. F.	350	Maybrook Electrical Co., Ltd.	28
Callender's Cable & Construction Co., Ltd. ...	174	Edison Swan Electric Co., Ltd.	23
Siemens Electric Lamps and Supplies, Ltd. ...	90	Parsons, F. J.	20
Baxter & Caunter, Ltd.	71	Sun Electrical Co., Ltd.	21
Burndept, Ltd.	22		

CARPAX CO., LTD.—First dividend of 3s. in £, payable at the offices of the liquidator, Mr. J. Wilson, 2, St. James Square, Manchester.

HIGHTOWN ELECTRICITY CO., LTD.—A meeting of creditors is called for December 29th at the liquidator's offices, 26, North John Street, Liverpool. Particulars of claims to the liquidator, Mr. H. Lonsdale, by December 31st.

J. H. RUNBAKEN, LTD.—Dividend of 1s. 10½d. in the £ to unsecured creditors, payable at the offices of the liquidators, Messrs. H. L. Price & Co., 47, Mosley Street, Manchester.

LIGHTING COMPONENTS, LTD.—A meeting of creditors was held on December 22nd.—Particulars of claims to the liquidator, Mr. J. Todd, 18, Birley Street, Blackpool, by January 25th. (This notice is purely formal, as all creditors have been, or will be, paid in full.)

MORGANS (BIRMINGHAM) ELECTRIC MOTORS, LTD.—A meeting of members is called for January 21st, at 4, Bennetts Hill, Birmingham, to hear an account of the winding up from the liquidator, Mr. H. J. Loveridge.

Dissolution of Partnership.

BONHAM & DOBIE, electrical engineers and contractors, 20, Pellatt Grove, Wood Green.—Mr. A. Bonham and Mr. D. J. Dobie have dissolved partnership. Mr. Dobie will attend to debts and continue the business.

Calendars and Diaries.

We have already received calendars and diaries from a number of companies and firms in the electrical trade and industry. These are always acceptable for the use of our various departments and the members of our staff.

Once again Messrs. SIMPLEX CONDUITS, LTD., have sent us one of their very serviceable pocket diaries with convenient daily engagement space for a week on the left-hand, with a week's squared memoranda space facing it.

The HART ACCUMULATOR CO.'s calendar follows the lines of its predecessor. The main feature is a pretty lady. There are monthly date sheets with bold figuring and illustrations of the company's products. The Hart Company has also sent us its blotter upon each sheet of which appears a calendar for 1928.

A supple pocket diary containing a great deal of useful data of pipes and fittings has been received from the STANTON IRONWORKS CO., LTD.

Mr. W. H. SQUIRE, of 31, Sweyne Avenue, Southend-on-Sea, has issued a wall calendar with monthly slips, and a coloured picture of a baby saying "Hello, Everybody!"

A picture of some sheep in a wire-netting pen appears on the 1928 calendar of Messrs. RD. JOHNSON, CLAPHAM AND MORRIS, LTD. The only advertisement upon the front is the company's trade mark "Jacem" upon each monthly slip. On the reverse are useful tables relating to iron wire, corrugated steel, &c.

Australia's Telephone Requirements.

The Australian Press reports that the Commonwealth Postmaster-General (Mr. Gibson) stated before the Commonwealth Committee of Public Works, at Canberra recently that he did not think it was possible for Australia to make its own telephones for the reason that English firms could manufacture the Commonwealth requirements, about 40,000 instruments, in a few weeks. Mr. Gibson said that the telephone system in Australia was developing more rapidly than anywhere else.

Wages in the Electricity Supply Industry.

Last week the employés' side of the National Joint Industrial Council for the Electricity Supply Industry tabled a request for a general increase of 1d. per hour in wages, the readjustment of the basis of assessment, the abolition of the sliding scale, &c. In response to the application the employers offered an increase of ½d. per hour, in addition to any advance which might become due under the cost-of-living adjustment, on condition that rates were stabilised for the whole of next year and that the sliding-scale agreement was reviewed during the course of the year. The offer was accepted, it being understood that the agreement should not apply to any area which was not covered by the national sliding scale agreement.

London Engineering Employés' Wage Demand.

The *Daily Herald* reports that the following resolution was unanimously adopted at a meeting last week of the London Engineering Joint Trades Committee, representing 17 trade unions:—"That the Joint Trades Committee, having considered the formation of a policy for a local increase in wages, recommends all district committees to endorse an application for 20s. a week increase on base rates to all engineering workers in the Greater London area at the earliest opportunity." It is pointed out that the period for which the recent advance of 2s. per week was definitely agreed expires on January 31st.

Strasburg Radio Syndicate.

The manufacturers and traders in the radio-electrical industries in Strasburg have decided to form a syndicate of the radio-electrical industries to group manufacturers, traders, and Strasburg radio representatives. This body will extend its activity to the departments of the Upper and Lower Rhine. —*Reuter's Trade Service* (Paris).

The Australian Electrical Market.

The United States Trade Commissioner in Sydney (N.S.W.), recently reported that the electrical equipment business in Australia was slow, with increasing competition. He states that the sale of electrical household equipment of German manufacture is markedly on the increase.

Czecho-Slovakian Electrical Imports.

During October last electrical machinery valued at 31,000,000 crowns (£190,000) was imported by Czecho-Slovakia. The total for the first ten months of the year was 195,000,000 crowns (£1,190,000).

The Bristol Electric Club.

As the result of discussions between Bristol electrical manufacturers and wholesale distributors the Bristol Electric Club has been formed. Its object is to foster good fellowship among its members and to further the interests of the electrical industry. For the present the Club's activities will be confined to monthly meetings, which will be of an educational and social nature. The officers of the club, however, have several ambitious schemes under discussion. An inaugural smoking concert will be held early in January at the Grand Hotel, Bristol, and a splendid programme has been arranged. During the evening an opportunity will be taken to explain fully the objects of the club. There are already over 100 members, and it is hoped to more than double this number. The hon. secretary is Mr. J. S. Mitchell, 1, St. James Parade, Bristol.

Unemployment.

There was a further increase in unemployment (4,370) during the week ended December 5th. The total number of persons in receipt of relief at that date was 1,149,600, as compared with 1,145,230 on November 28th, and with 1,506,320 on December 6th, 1926.

Propaganda by the Ton.

In the course of a recent direct mail publicity campaign the Bradford Corporation Electricity Department distributed 3½ tons of literature to its domestic consumers. Altogether 225,000 pieces were sent to 15,000 consumers—an average of 15 pieces or about half a pound each—a weighty argument in favour of electricity in the home.

German High-Tension Insulators.

The High Tension Insulator Syndicate of Berlin is to be prolonged until the end of 1932. Through this long extension it is hoped to make further progress in the direction of the standardisation of types and to obtain greater economy in the works.

Swiss Duty on Electric Vehicles.

As from November 1st last, the duty on electric vehicles imported into Switzerland has been fixed at 120 fr. (about £4 16s.) per 100 kg.

Local Exhibition.

The Barnsley Corporation Electricity Committee has recommended that an electrical exhibition be held in the Public Hall next February at a cost of £400.

British Aluminium Extensions.

The British Aluminium Company is carrying out extensions of the buildings and plant at its Burntisland works, which will practically double their capacity. It is understood that the cost of the extensions, exclusive of the new machinery, will be about £50,000, and that the work will take a year to complete.

Australian Arbitration Act Amendment.

In the Commonwealth House of Representatives on December 15th, the Attorney-General submitted important measures for the amendment of the Arbitration Act providing for secret ballots where ten or more members of a union demand this and also "outlawing" strikes and making "black" declarations an offence. If a lock-out occurs in an industry, a strike in that industry will not be regarded as an offence and *vice versa*. The penalties for lock-outs are reduced where the responsible organisation endeavours to prevent the offence. The measure provides for a penalty of £1,000, imposable only on employés' organisations, the maximum for other persons being £50. Organisations are made responsible for the actions of their members, the liability being limited where the organisations expel the offenders.—*Reuter* (Canberra).

Holiday Notices.

Messrs. Newtons, of Taunton, announce the closing of their works and offices from the evening of December 23rd until the morning of Wednesday, December 28th.

The works of Venner Time Switches, Ltd., will be closed from Saturday (24th inst.) midday until the morning of Thursday, December 29th.

For Sale.

Bedford Corporation Electricity Department invites offers for one 1,000-kW mixed-pressure turbo-alternator and condensing plant. Sydney, New South Wales, Electricity Department invites offers for two 1,000-kW rotary convertors and transformers. (See our advertisement pages to-day.)

Aiding the Fleetwood Fund.

An excellent concert was given at Hollinwood on December 11th in support of the Fleetwood Disaster Relief Fund. The programme was given by the Ferranti augmented orchestra, assisted by Miss Hilda Pearson and Mr. Sydney Hutchins, vocalists. The band was conducted by Mr. D. S. Black; Mr. John Bradley was a proficient leader, and Mr. Gordon Collier excelled as a pianist. The audience was large and appreciative, and the concert closed with a hearty expression of appreciation.

New Municipal Showrooms.

The Buxton Electricity Committee has secured a shop in the Town Hall Arcade which will be utilised as an additional showroom.

The Millionth Valve-Holder.

With reference to the recent offer of Benjamin Electric, Ltd., of a presentation gold watch to the trader receiving the millionth "Benjamin" anti-microphonic valve-holder, and another to the factor claiming the million-and-first, the winners are, respectively, Mr. H. J. Radford, Bristol, and Messrs. Hirst, Ibbetson & Taylor. Ltd., Manchester.

The Ex-B.W. Association.

We have received from the hon. secretary of the ex-British Westinghouse Association, Mr. L. S. Richardson, Preston Road, Wembley Park, a copy of "Inter Nos," the Association's infrequent journal. This, as usual, is produced in a vein of excellent humour and contains a report of the annual dinner. The next dinner is at the Hotel Cecil on March 2nd.

The Radio Manufacturers' Association.

The officers of this association for the ensuing year are: President, Sir William Bull, Bt., M.P.; vice-president, Mr. W. H. Goodman (Dubilier Condenser Co. (1925), Ltd.; chairman, Mr. A. E. Bowyer-Lowe; vice-chairman, Capt. S. R. Mullard; trustees, Messrs. J. Joseph (R. I. and Varley, Ltd.), J. T. Mould (Igranic Electric Co., Ltd.), and A. E. Bowyer-Lowe.

E.D.A. Display of Electrical Films.

The last conference of the year arranged by the British Electrical Development Association was held on Friday last, December 16th, at the Royal Society of Arts, and was devoted to the showing of a series of electrical kinematograph films. There was a very large audience, the hall being filled to overflowing, and it was obvious that the event was one of the most popular in the season's programme. There is no doubt that the film is an excellent means of electrically educating those who are devoting their careers to the salesmanship side of the industry. The proceedings were opened by Mr. V. W. Dale, the business manager, who said that as Mr. Beauchamp, the director, was retiring, it was regrettable that he could not be present on this occasion, but they looked forward to his frequently presiding at future conferences. The films dealing with the progress of lighting throughout the ages and depicting the production of the modern electric lamp were very effective, and the views of electric ploughing and electric bee-keeping were made particularly informative by the accompanying explanations given by Mr. R. Borlase Matthews. Other films included: The Romance of Broadcasting, giving some excellent views of the equipment and working of 2LO; the transmission and reception of telegraphic messages at Electra House, the headquarters of the cable companies, and a vivid portrayal of two historic engineering feats, namely, the construction of the great Dam on the Nile and the construction of the Panama Canal.

The E.D.A. has fourteen films with story scenarios, dealing mainly with the uses of electricity in the home, which can be hired for use in local kinema theatres. The Association acknowledged its indebtedness to the following for the loan of the films shown:—Siemens Electric Lamp & Supplies, Ltd.; Gaumont Co., Ltd., New Era Films, Ltd., British Thomson-Houston Co., Ltd., French Film, Mr. R. Borlase Matthews, and C. A. Parsons & Co., Ltd.

Prices of Raw Materials.

In their letter dated December 17th, Messrs. James Forster and Co. stated that the quiet conditions prevailing in the lead market were not uncommon at this time of year. Arrivals, owing to the diversion of considerable quantities of Australian lead to the Continent, are likely to be on the light side this month, and this would account for the steady tone of the market in face of the reduced demand. The Board of Trade returns for November show:—Imports, 22,419 tons; exports, 1,935 tons; leaving for home absorption, 20,484 tons.

Messrs. F. Smith & Co. report, December 20th:—Copper (electrolytic) bars, £66 15s., 2s. 6d. inc.; do., sheets, no change; do., wire rods, £76 15s., 2s. 6d. inc.; do., H.C. wire, no change.

Messrs. James & Shakespeare report, December 20th:—No change in the prices of copper bars (best selected), sheet and rod, and English pig lead.

Messrs. Edward Till & Co. report, December 20th:—No change in the price of india-rubber, para fine.

Lighting and Power Notes.

Australia.—VICTORIA.—According to the *Electrical Engineer of Australia and New Zealand*, during the year ended June 30th last the State Electricity Commission of Victoria was able to meet out of revenue all operating expenses, and interest on capital expenditure and on past deficiences, but not depreciation. The revenue was £1,181,000. The principal items of capital expenditure during the year were as follows:—Yallourn power station, £103,000; coal winning, £233,000; main distribution system, £263,000; Sugarloaf-Rubicon hydro-electric scheme, £195,000; country and metropolitan districts, £315,000. For the financial year 1927-28 the capital expenditure is estimated at £1,750,000. This includes £350,000 for extensions and conversion from single-phase to three-phase in the Melbourne Electric Supply Co.'s area, £200,000 for new distribution works, £400,000 for coal supply works, and £500,000 for power generation works, including the Sugarloaf-Rubicon hydro-electric scheme and the installation of a generator at the Richmond power station.

Bangor.—ELECTRICITY EXTENSION.—The City Council has approved a scheme for the supply of electricity to Penrhyn Castle and Port Penrhyn at a total cost of £16,554, and has authorised the commencement of the first section forthwith at a cost of £4,883.

Birkenhead.—EXTENSION OF SUPPLY.—The Corporation on December 15th inaugurated a supply of electricity to Heswall and adjoining districts as part of the scheme for the linking up of outlying areas in the Wirral Peninsula. In the new area which is being served by the Corporation there will be 12 transformer stations with sub-stations at Eastham, Moreton and Prenton Bridge. From Prenton Bridge, overhead transmission lines will be continued in one direction to Thurstaston and in the other to Little Neston, whence a further overhead line will connect up Little Sutton to Eastham. Between Birkenhead and Eastham there will be underground mains, and at various points the overhead lines will be tapped to supply the various townships. The overhead h.p. lines across the Wirral Peninsula extend over 14 miles. Work was recently commenced on the erection of the overhead line through Thornton Hough to Neston, and it is expected that electricity will be available in this township in January. The original estimate for this electrification scheme was £60,000, which is being borne by the Birkenhead Corporation. Consumers in the Wirral area will be charged 25 per cent. more than consumers in the borough of Birkenhead.

ELECTRICAL EXHIBITION.—The Corporation inaugurated an electrical exhibition at Heswall on December 19th.

Birmingham.—SCHEME APPROVED.—At a meeting of the City Council on December 13th the report of the Electric Supply Committee, recommending an expenditure of £804,000 on mains and £288,000 on sub-stations, buildings and plant, was approved.

Bradford.—LOAN SANCTIONED.—The Corporation Electricity Committee is applying for sanction to a loan of £150,000 for mains and services.

Bromley (Kent).—LOAN SANCTIONED.—The Town Council has received sanction to an additional loan of £5,027 for electricity purposes.

MAIN EXTENSION.—The main at Bromley Common is to be extended to supply electricity to the hospital of the West Kent Joint Hospital Board at a cost of £2,080, provided the Board guarantees a minimum payment of £250 for a period of five years.

LOAN.—Further mains extensions are to be carried out, and for this purpose a loan of £11,313 has been applied for.

Carlisle.—LOANS.—The City Council has applied for sanction to a loan of £52,614 in respect of the completion of the works at the power station. The total expenditure was £237,614, and sanction has already been received to the borrowing of £185,000. A loan of £642 has also been applied for to give a supply of electricity outside the existing area of supply, for which an Order is being sought.

Canada.—HYDRO-ELECTRIC DEVELOPMENT.—The Dominion Water Power and Reclamation Service at Ottawa has just issued a bulletin dealing in detail with the water-powers of Canada, giving a general survey of the water-power industry and resources throughout the Dominion. The report states that only about one-tenth of the water-power of Canada has yet been developed. The aggregate installations place Canada second only to the United States, and the *per capita* development (513 h.p. per 1,000 of population) is second only to Norway. A recent study relating to the outlook in only two provinces, *i.e.*, Ontario and Quebec, indicates that the installed h.p. will probably increase from 3,522,000 in 1925 to about 8,150,000 in 1945. The new capital required for the development, transmission and distribution of this power will probably be not less than $1,369,000,000 during the twenty years, or an average of over $68,000,000 per year.

An agreement entered into between the Whtney interests of New York who are taking over the Flin Flon copper deposits of Northern Manitoba, which they have been operating under option, and the Canadian Government includes the development of electric power on an extensive scale. A new company is to be formed to develop White Mud Falls on the Nelson River and Island Falls on the Churchill. This company must sell power not only to the Flin Flon, but to other mines at a rate fixed by the Manitoba Public Utilities Commission. The power leases are to be for 50 years, but may at any time be taken over by the Manitoba Government at a price fixed by arbitration. The possible power development at these two points is about 400,000 h.p. The company will be formed from those interested in the Flin Flon and Gordon Sherritt properties.

Colchester.—ELECTRICITY SUPPLY.—The Town Council has arranged to give a supply of electricity to the L. & N.E.R. Railway Co. for North and St. Botolph's stations, and also to a laundry. The annual consumption is estimated at 79,000 kWh.

Continental.—POLAND.—In order to meet the increasing demand for electricity a new 12,500-kW steam turbo-generator is being installed at the power station of the Société Centrale Electrique Regionale du Bassin de Cracovie, at Cracow, which will bring the capacity of the plant up to 22,500 kW. A scheme is also under consideration for the provision of a h.p. transmission line between the station at Cracow and that of the Société Centrale Electrique du Bassin de Dombrowa, so that, in times of emergency, supplies can be drawn from the last-named plant.

East Grinstead.—LOAN.—The Urban District Council has applied for sanction to a loan of £4,500 for mains and services.

Falmouth.—INSTITUTION SUPPLY.—The Board of Guardians has adopted a recommendation of the House Committee to accept an offer to supply electricity to the institution at a minimum annual payment for electricity and meter rent of £100 and a further sum of £300 as a contribution towards the cost of making the necessary extension of mains.

Grange-over-Sands.—LOAN SANCTIONED.—The Urban District Council has received sanction to a loan of £4,400 for electricity extensions.

Inverness.—PROPOSED REFUSE PLANT.—The Town Council has requested the Electricity and Cleansing Committee to report as to the advisability of installing suitable plant for utilising refuse at the electricity works.

LOAN.—Application is being made for sanction to a loan of £7,450 for the installation of a 150-h.p. water turbine and gear-driven generator at the Buight hydro-electric power station, and also for a new feeder to convey the electrical energy to the town network.

Japan.—ELECTRICAL DEVELOPMENT.—The Toyama Denki is reported to have decided to purchase for its Koguchi-gawa No. 3 power station two 7,000-kW turbines, seven transformers and switchgear.

The Sanriku Hydro-Electric Power Co. is in course of formation. A concession has been granted for the erection of two power stations with a total capacity of 6,344 kW.

The Tokyo Municipality is erecting at Shibaura a steam power station of 10,000 kW, which will be completed by March next year. The municipality is considering the erection of another power station, as the one now under construction is thought to be insufficient to meet anticipated demands.

Leslie (Fife).—At a recent meeting of the Town Council letters were read from the Fife Electric Power Company offering to lay the necessary cable to supply electricity to 40 houses erected by the Council and from the local Gas Company asking for a grant of £30 towards the cost of laying gas pipes to the houses. It was agreed to introduce electricity.

Llandrindod Wells.—LOAN SANCTIONED.—The Urban District Council has received sanction to a loan of £4,400 for a new oil engine at the electricity works.

London.—PRICE REDUCTIONS.—The County of London Electric Supply Co., Ltd., is to reduce its charges for electricity. The reductions will take place in two stages, the first to date from the end of the current month. The immediate reductions are 1½d. per kWh for lighting and the abolition of the 40 per cent. addition to the basic price for heating and cooking. Further reductions will take place from June, 1928.

Louth.—ELECTRICITY SUPPLY.—According to the *Yorkshire Post*, the Town Council has decided to accept the terms offered by Grimsby Corporation to supply the town with electricity. The estimated cost of the scheme is £26,806, and it is suggested that a preliminary loan of £9,000 be raised. There will be a first charge of £300 per annum, except during the first two years, to be reduced as the demand created exceeds certain defined limits.

Maybole.—INAUGURATION OF SUPPLY.—An electricity supply for the district was formally inaugurated on December 14th.

Motherwell.—HIRE-PURCHASE SCHEME.—The Town Council has adopted a recommendation of the electrical engineer that a scheme be inaugurated for the provision of wiring and fittings on a hire-purchase basis in houses of five rooms and under, and is to borrow £2,000 for the purpose.

North Walsham.—INAUGURATION OF SUPPLY.—An electricity supply for the district was formally inaugurated by the chairman of the Urban District Council on December 6th. Electricity is transmitted from Norwich Corporation power station by an overhead line which is designed for 33,000 V, to be transformed down at North Walsham to 6,600 V, though at present the latter voltage only is being used. The pressure is reduced to 220 V at sub-stations in the town for general distribution.

Oswestry.—PURCHASE OF UNDERTAKING.—The Town Council has authorised the Town Clerk to instruct its Parliamentary agent to seek powers whereby the Corporation would be in a position to acquire the whole of the undertaking of Oswestry Electric Lighting and Power Co., Ltd

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

SOUTHAMPTON.—Lighting: First 5,000 kWh per quarter, 4d. per kWh; next 5,000 kWh, 3¼d.; over 10,000 kWh, 3d. An addition of ¼d. per kWh is made to these charges to consumers outside the borough. Heating and cooking: Within the borough, 1d. per kWh; outside the borough, 1¼d. per kWh. Alternative residential tariff: Within the borough, a standing charge of 2s. per room per quarter during the summer quarters, and 4s. during the winter quarters, plus ¾d. per kWh; outside the borough, 2s. 3d., 4s. 6d., and 1d., respectively. Power: First 5,000 kWh per quarter, 1¼d. per kWh; next 5,000 kWh, 1¼d.; over 10,000 kWh, 1¼d. An addition of ¼d. per kWh is made to consumers outside the borough.

BURNLEY.—Lighting: 4¼d. per kWh. Heating and domestic appliances: 2d. per kWh. Power: Varying from 2d. to 1d. per kWh.

Shrewsbury.—NEW PLANT.—The Corporation Electricity Committee is considering the installation of a second 400-kW Diesel oil-engine set at the electricity works.

South-East Lancashire Electricity Advisory Board.—FRINGE ORDERS.—The Engineering Advisory Committee has recommended the Board to support the applications for Fringe Orders by the Cheadle and Gatley Urban District Council to supply electricity to properties in the urban district of Handforth and the parish of Northen Etchells, the Electricity Company of Macclesfield, Ltd., to supply in the parishes of Sutton and Prestbury, and the Hazel Grove and Bramhall Urban District Council to give a supply to certain premises in the parish of Woodford.

POWER STATION EXTENSIONS.—The Committee has been notified that sanction has been given to extensions at Stockport power station by the installation of one 20,000-kW turbo-alternator and four 50,000-lb. boilers.

SPECIAL ORDERS.—The Board has been recommended to support the application of Manchester Corporation for a Special Order to supply electricity in the parishes of Northenden, Northen Etchells, and part of the parish of Baguley.

The proceedings of the Engineering Advisory Committee have been approved by the Board.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by the Aldershot Gas, Water and District Lighting Co., authorising it to supply electricity in certain parishes in the rural districts of Guildford, Midhurst, Hambledon, Alton, Horsham and Petworth; the Eastbourne Corporation to supply electricity in parts of the rural districts of Eastbourne and Hailsham; the Marple Urban District Council to supply electricity in its area; the Cleveland and Durham County Electric Power Co. to supply in parts of the rural districts of Stokesley, Middlesbrough, and Guisborough; and Clitheroe Corporation to supply electricity in part of the rural district of Bowland.

The Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the Pooley Hall Colliery Co., Ltd., to supply electricity in the rural district of Tamworth and part of the rural districts of Atherstone, Ashby-de-la-Zouch and Market Bosworth.

Teignmouth.—ELECTRICITY SUPPLY.—The Teignmouth Electric Lighting Co., Ltd., has purchased the undertaking of Heath Bros. at Buckfastleigh, and is taking steps to secure an Order to supply electricity in the urban district of Buckfastleigh and other parishes adjoining. The Torquay Town Council has arranged for the Teignmouth Co. to supply electricity in the urban district of Buckfastleigh and the parishes of Mortonhampstead, Lustleigh, Manaton, North Bovey, and Ilsingdon, providing that the work is commenced within two years after the Corporation's Order including these parishes is obtained.

Tunbridge Wells.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £6,839 for transformers.

Walsall.—MAINS EXTENSIONS.—The Corporation Electricity Committee is to extend the mains to Essington at a cost of £2,800.

Tramway and Railway Notes.

Dutch East Indies.—BANDOENG.—An Amsterdam company has applied for a concession for the construction and operation of an electric tramway in the town of Bandoeng, Java.

Greenock.—OPPOSITION TO SCHEME.—The recommendation of a Joint Committee of representatives of Greenock, Port Glasgow, and Gourock Town Councils to oppose a Provisional Order which the Greenock and Port Glasgow Tramways Company is promoting regarding the running of tramcars and motor-'buses has been confirmed at a special meeting of Greenock Corporation.

Madagascar.—RAILWAY ELECTRIFICATION.—Operations have recently been commenced on the electrification of the railways in the Island of Madagascar, a start being made with the line between Tamatave and Tananarivo. The work includes the establishment of two hydro-electric stations to supply the necessary power. One plant of 17,000 h.p. will utilise the power of the river Vohitia, near Farastana, and one of 13,000 h.p. will be situated on the River Onire, near Isinjoarne. Later the line between Fianarantava, and the east coast of the island is also to be electrified and a second track constructed.

Manchester.—EXTENSION TO DEPOT.—According to the *Electric Railway and Tramway Journal*, extensions to the Hyde Road tramway works are to be made at a cost of £92,244. When these extensions are completed it is proposed to build there all the tramcar bodies which may be required for the future operation of the Corporation tramways.

Stockton.—SALE OF POWER STATION.—Negotiations are taking place between the Middlesbrough and Stockton Corporations with a view to the sale of the tramway power house at Stockton, which has been in disuse since the joint Corporations bought the system from the Imperial Tramways Co. eight years ago.

Walsall.—PURCHASE OF TRAMWAY.—The Town Council has been recommended to approve the purchase from the Wolverhampton District Electric Tramways, Ltd., of the tramway from Crescent Road to the Market Place, Willenhall, at a cost of £5,500.

Telegraph and Telephone Notes.

"Beam" Radio-telegraphy.—ANGLO-AMERICAN SERVICE.—Marconi short-wave "beam" services are now in operation from England to New York and South America, *i.e.*, Rio de Janeiro and Buenos Aires, the New York service supplementing the long-wave services which have been operated from the Marconi main telegraph office at Radio House, London, for some years. The South American services are entirely new, and place Brazil and the Argentine in direct wireless communication with London for the first time. The "beam" service operates both to and from Rio de Janeiro, but at present Buenos Aires has no "beam" aerials, so that while messages are sent from London by "beam" to Buenos Aires, there is no "beam" in the reverse direction. The services are operated from Radio House by remote control, *i.e.*, signalling keys in London, the transmitting stations for the North and South American services being situated at Dorchester, and the receiving station at Somerton, about 30 miles from Dorchester. They are normally worked at between 100 and 200 words a minute, although over 300 words a minute have been worked quite satisfactorily during tests. The transmitting aerials that have been built by the Marconi Company at Rio de Janeiro have been so constructed that London, Paris, and Berlin will be within the "beam" when it reaches Europe, and the Rio stations can handle traffic for all three capitals. "Beam" receiving aerials are now being built near Paris for receiving from America, but none are yet in existence in Germany. "Beam" stations are also being constructed at Dorchester for communication with Egypt, in Egypt for communication with England, and at Dorchester for communication with Japan and the Far East.

Germany.—AUTOMATIC TELEPHONY.—The bulk of the telephone service of the City of Cologne was changed over to the automatic system during the night of December 10th. The operation took several hours, and for that period the telephones could not be used, much dislocation resulting in consequence. The initial numbers of the previous system have been retained, giving the five integers which are necessary for the working of the automatic system.—*Reuter* (Cologne).

PHOTO-TELEGRAPHY.—Most of the Berlin newspapers on December 1st published photographs telegraphed from Vienna. It was the first day of the new public service, and Prof. Carolus, the inventor of the process, states that "we can now telegraph a picture, post card size, in 10 minutes." The cost is 8s. for this size.

International Telephony.—LONDON-MADRID SERVICE.—The National Telephone Company, which holds the monopoly of the telephone service in Spain, announces that communication between Madrid and London will be opened in a few weeks on a circuit through Paris. *The Times* expects that next June a direct service between Madrid and London without the intervention of Paris will be available, and that it will be possible to establish communication by wireless telephony between Spain and the United States, Canada and Cuba through this direct line to London.

Philippine Islands.—CABLE REPAIRS.—The Philippine Government telegraph cable lines were recently being repaired, a shipment of some 25 miles of submarine cable having been received by the insular Bureau of Posts from London, England, says the *T. & T. Age*. The greater portion of the new cables will be used to replace the old ones between Manila and Iloilo and Cebu in the Visayan Islands.

Switzerland.—A LEAGUE WIRELESS STATION.—A committee of experts has been summoned to meet in January, 1928, to finish the technical examination of the question of the establishment of a League of Nations wireless station. In December, 1926, the Council asked the Committee on Communications and Transit to undertake immediately the necessary studies in order that the League might have at its disposal a sufficiently powerful wireless station to enable it to communicate by its own means with the greatest possible number of member States of the League, and to present a report to the Council so soon as possible on the subject. The Committee of Experts now summoned will determine in particular the essential features of a station to meet the League's requirements, the expenditure on building and unkeep, and general conditions of operation from technical and administrative points of view. On receiving the report the Transit Committee intends to establish a draft budget for the equipment of the station, to invite tenders from firms which, if necessary, might undertake the construction, calculate the possible extent of the traffic, and lay down the terms of the agreement necessary with various public or private wireless undertakings as regards the conditions of the exchange of traffic. It will be possible to submit the final report of the Transit Committee to the Council in 1928. The Committee of Experts is composed as follows:—Mr. Einthoven, wireless engineer at The Hague; General Ferrie, director of the military wireless organisation in the French War Ministry, president of the International Committee for Wireless Telegraphy; Dr. Jaegers, adviser in the German Postal Ministry; Colonel Lee, of the British General Post Office; and Prof. Vallauri, of the Royal Naval Academy, Livorno.—*Reuter* (Geneva).

Turkey.—NEW RADIO STATION.—It is reported by the *Financial Times* that the new radio-telegraph station at Angora has been carrying out tests with London recently, and that it is hoped to establish regular communication in January, 1928.

Radio Notes.

France.—GOVERNMENT REORGANISATION.—It seems that the shelving by the Chamber of the proposed duty of 10 francs on wireless sets, mentioned last week, will affect the service much more than appeared at first sight. M. Bokanowski, who, as Minister of Posts and Telegraphs, is responsible for the control of broadcasting, lets it be understood, says *The Times*, that, unless the Chamber takes up the duty again at the second reading of the Finance Bill, the greater part of the musical and theatrical programmes of the French stations must be suppressed. Hitherto, it appears, the stations, most of which belong to the Government, have been able, in the absence of any law protecting authors' copyright, to transmit musical and theatrical performances without paying any royalties. A Decree issued last December put a stop to this state of affairs, and the new *régime* is to come into force at the end of this year. The new tax was to provide the Government with funds with which to pay the royalties.

Some of the private stations will not survive the New Year, as the high taxes the Government proposes to levy on them are exorbitant, states the Paris technical Press. The decision to tax private transmitters and receivers was the principal recommendation of the Departmental Commission set up in Paris under the broadcasting reorganisation decree of December 26th, 1926.

According to *World-Radio*, Radio-Paris will blossom where other stations fade. This high-power station is going to have a new studio in a few days' time, and the power is going up to 20 kW.

United States.—RADIO WIRING RULES.—An interesting article in the *T. & T. Age* explains, *inter alia*, that in 1920 the Institute of Radio Engineers and manufacturers co-operated with the National Fire Protection Association in working out rules governing radio installations, and many of the long-established National Electric Code rules cover much of the detail, such as storage batteries, motor generators, rectifiers, &c. Rule 37 of the Code applies specifically to radio, and at the 1927 annual meeting of the Association the Article Committee on Rule 37 made some recommendations for changes which very likely will appear in the next edition of the Code, which is divided into two parts: one governs mainly the construction and mechanical support of the antenna, the earth (or counterpoise system) and protection of the system from heavy static accumulation and discharge due to lightning; the second part has to do with transmitting installations.

Six years' experience has led members of the Code Committee to believe that the addition of an earthing switch contributes nothing of advantage in the way of protection; in those cases of the switch having served to prevent damage, in most instances it was apparent that the arrestor employed was not of good design, was too small in dimensions, or was not constant and dependable in action. Arrestors are intended to discharge from line to ground any foreign current due to a potential exceeding the breakdown potential of the arrestor, say, 400 volts. The insulation resistance between the line and ground terminals, with d.c. of not less than 100 volts, should be not less than 100 megohms when dry and not under 10 megohms under service conditions, out of doors. "Eliminators," battery substitutes, &c., introduce a hazard which only intelligent design of apparatus, proper installation and care in handling can guard against. It is possible that future issues of the Code will be more specific and exacting. A serious hazard is that the antenna may fall or swing into contact with high-voltage power wires; indeed, already much of the damage done has been due to just such happenings.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Ampthill.—December 24th. Board of Guardians. Electric wiring and fittings at the Institution. Mr. L. Foster, surveyor, Flitwick.

Argentina.—BUENOS AIRES.—January 17th. National Sanitation Works Department. Three 350-kW Pelton-type turbines and 6,600-V, three-phase generators. Two 20-kVA, 3-phase static transformers, one distribution switchboard and connections. (B.X. 3921.)*

Australia. — MELBOURNE. — January 3rd. Postmaster-General's Department. Switchboard lamps, lamp caps, and lamp sockets. (B.X. 3943).*
January 23rd. State Electricity Commission of Victoria. 6,600-V automatic induction voltage regulators. (B.X. 3972.)*
January 31st. Sub-station protectors, mountings, fuses and heat coils for telephone exchanges. (B.X. 4019.)*
January 25th. Victorian Railways. Electric colour light signals and brackets. (B.X. 4069.)*
SYDNEY.—February 1st. New South Wales Government Railways. One 3,000-kW rotary-convertor unit for Hornsby sub-station, one ditto for St. Leonards sub-station. Chief Electrical Engineer, 61, Hunter Street, Sydney.
January 9th. Municipal Council. 11,000-V metal-clad switchgear for sub-stations. Construction Engineer, Electricity Department, Town Hall, Sydney.

Birmingham.—January 9th. Tramways and Omnibus Committee. Supply and delivery of 50 new tramcar bodies. Form of tender from Mr. A. Baker, general manager, Tramway Offices, Council House, Congreve Street.
January 10th. Electric Supply Department. Three 2,000-kW rotary-convertor equipments; two 1,000-kW ditto and two 750-kW ditto. (December 16th.)

Chile.—SANTIAGO.—March 7th. Ports Commission. Five electric travelling portal cranes for Punta Arenas. (A.X. 5648.)*

Darfield.—January 17th. Education Committee. Installation of electric light at Darfield New Infants' School. Particulars from the Education Department, the County Hall, Wakefield.

Forfarshire.—December 29th. Education Authority. Electric lighting installation for the Brechin High School, additions, &c. Schedules from Mr. J. Eadie, clerk and treasurer, Education Offices, Forfar.

India.—January 13th. India Stores Department. Two water-tube boilers, stokers, and condensing plant; two 300-kW high-speed vertical steam generator sets and condensing plant; one h.p. cubicle switchboard and one l.p. a.c. ditto; two 200-kVA transformers. Forms of tender from India Stores Department, Belvedere Road, S.E.1.

Leicester.—January 21st. Electricity Department. Buildings, coal- and ash-handling plant, railway sidings, &c., three water-tube boilers complete, one 25,000-kW and one 1,500-kW turbo-alternators with condensing plant and accessories, and three ferro-concrete cooling towers. (December 2nd.)

London.—BETHNAL GREEN.—December 29th. Board of Guardians. Electric passenger lift, &c., at the Institution, Waterloo House, Bethnal Green, E. (December 2nd.)
ISLINGTON.—January 20th. Electricity Department. 12 months' supply of cables, meters, transformers, lamps, wires, &c. (December 16th.)
H.M. OFFICE OF WORKS.—January 5th. Rewiring work (in steel conduit) at the Ministry of Pensions Hospital, Orpington, Kent. Contract Branch, King Charles Street, S.W.1.
January 12th. Crude oil engine-generator set, booster set and panels for the Ministry of Labour, Meeting Hall, Brandon, Norfolk. (See this issue.)
CAMBERWELL.—January 16th. Borough Council. Twelve months' supply of electric lamps and maintenance of electric lighting, heating and power installations, telephones, &c. Forms of tender from Mr. W. Bell, borough engineer and surveyor, Town Hall, Camberwell, S.E.

Lourenco Marques.—February 13th. Ports and Railways. Two 350-h.p. electric motors. (B.X. 3996.)*

Manchester. — January 3rd. Electricity Committee. Low-pressure auxiliary pipework. (December 9th.)

New Zealand.—WELLINGTON.—January 10th, 1928. Public Works Department. Additional 110,000-V switchgear, steelwork and control board for Arapuni electric power supply. (B.X. 3837.)*
January 17th. 110,000-V switchgear protective apparatus, steelwork, storage batteries, &c., for the Waikaremoana power scheme. (B.X. 3858.)* 50,000-V switchgear and steel work for Arapuni. (B.X. 3917.)* 11,000-V switchgear and metering equipment for Arapuni (Sec. 254). (B.X. 3920.)*
January 24th. 11,000-V switchgear and metering equipment for Arapuni (Sec. 261). (B.X. 3918.)*
February 18th. Storage battery and motor for Arapuni. (B.X. 4032.)*
April 21st. New Zealand Government Railways. Machine tools and workshop equipment. (A.X. 5647.)*
January 25th. Post and Telegraph Department. Telephone switchboard plugs. (B.X. 4073.)*
April 17th. Sub-station protectors. (B.X. 4074.)*
TE AROHA.—January 17th. Thames Valley Electric Power Board. Thirty 11,000/415-V transformers. (B.X. 4075.)*
CHRISTCHURCH.—March 13th. Drainage Board. Nine electric centrifugal sewage pumping plants. (A.X. 5457.)*

South Africa.—JOHANNESBURG.—January 3rd. Municipal Council. 32 transformers. (B.X. 3991.)* Electric lamps and holders. (B.X. 4042.)*
December 29th. S.A. Railways and Harbours. One 5-ton 3-motor electric overhead travelling crane for East London workshops. (A.X. 5506.)*
February 2nd. One electrically-driven heavy duty wheel lathe. (A.X. 5678.)*
GIVELO.—January 10th. Municipal Council. Supply of motors, fans, meters, &c. (B.X. 4059.)*

Stafford.—December 31st. Education Committee. Installation of electric lighting and power in the Friary School, Lichfield. (December 9th.)

Swindon.—January 14th. Electricity Department. 6,600-V and 3,300-V a.c. and 440-V d.c. switchgear. (December 16th.)

Uruguay.—MONTEVIDEO.—January 21st. State Electricity Works. Overhead sub-stations and switching towers. (B.X. 4028.)*
February 1st. 153,000 metres of galvanised flexible steel cable for guard wire. (A.X. 5654.)*
February 2nd. Installation of a telephone system between various localities. (B.X. 4082.)*
February 5th. Ministry of Public Works. 22 cranes for the Hydrographic Department. (A.X. 5478.)*

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Amblecote.—
Installing electric lighting at Brettle Lane United Methodist Church.—D. Holmes (Stourbridge). (Accepted.)

Bexhill.—Electricity Committee. Recommended :—
500 yards .06 three-core cable (£122).—Enfield Cable Works, Ltd.

Bradford.—Housing Committee. Accepted:—
Electric lighting at housing estates at Shirley Manor (200) (£775); and at Bierley (14) (£62).—A. Higginbotham & Sons.

Tramways Committee. Accepted :—
7,200 yd. copper trolley wire (£406).—Collier Bros., Ltd.
100 steel tramcar axles (£587).—Brown, Bayleys Steel Works, Ltd.

Brighton.—Lighting Committee. Accepted:—
Reinforced-concrete work at Southwick power station (£2,650).—A. E. Farr.
Voltage regulation equipment (£189).—Metropolitan-Vickers Electrical Co., Ltd.
Boiler accessories at Southwick works (£8,478).—Richardsons, Westgarth & Co., Ltd.

E.h.p. switchgear, &c. :—

A. Reyrolle & Co., Ltd.	£20,053
General Electric Co., Ltd.	18,892
Ditto (alternative)	18,936
Metropolitan-Vickers Electrical Co., Ltd. (Accepted.)	**15,825**
Ditto (alternative)	14,238

Erecting reinforced-concrete monolith and raft to support turbo-alternator set at Southwick (£2,878).—Bierrum & Partners. (Accepted.)

China.—SHANGHAI.—It is stated in Prague that the Skoda Works have received an order for material for the central electricity station at Shanghai of the value of 25,000,000 crowns (£150,000). The contract was secured against British, German and American competition.—*Reuter* (Prague).

Doncaster.—Town Council. Accepted:—
Pumps, motors and electrical gear, &c., for the sewage scheme (£2,286).—J. Stone & Co., Ltd.

Glasgow.—Corporation. Accepted:—
Electric lighting installation at the Parkhead Halls (£195).—J. Wright.

Harrogate.—When the subject of foreign tenders for cables was before the Town Council meeting on December 12th, the Electricity Committee was authorised to accept British tenders if satisfactory terms could be arranged. It was stated that a Dutch offer had been received showing a very low price.

Lancaster.—Electricity Committee. Accepted :—
Cables for 12 months.—British Insulated Cables, Ltd.
One 5,000-kW turbo-alternator, surface condensing plant, switchgear, cables, pipework, foundations, and one 20-ton electrically-operated crane (£18,576).—Metropolitan-Vickers Electrical Co., Ltd.

Liverpool.—Electric Power and Lighting Committee. Accepted :—
Four 750-kVA transformers.—Metropolitan-Vickers Electrical Co., Ltd. (£1,809); four ditto, English Electric Co., Ltd. (£1,809); and four ditto, General Electric Co., Ltd. (£1,809).
One master clock and three secondary electric synchronising clocks.—Gent & Co., Ltd.

London.—LONDON COUNTY COUNCIL.—Education Committee. Wiring and fittings for electric lighting, power, bells and telephones at Highbury Hill High School :—

Alpha Mfg. and Electrical Co., Ltd. (Accepted.)	**£950**
Cox-Walkers	1,009
H. J. Cash & Co., Ltd.	1,039
T. Clarke & Co., Ltd.	1,095
L. G. Tate & Co., Ltd.	1,170
J. Briggs, Electrical Contractors, Ltd.	1,203
Burdette & Co., Ltd.	1,293
G. Hopkins & Sons (Clerkenwell), Ltd.	1,425
Malcolm & Allen (London), Ltd.	1,445

Highways Committee. E.h.p. switchgear for sub-station—

*Ferguson, Pailin, Ltd.	£1,109
Metropolitan-Vickers Electrical Co., Ltd. (Accepted.)	**1,155**
A. Reyrolle & Co., Ltd.	1,167
British Thomson-Houston Co., Ltd.	1,533

* Not to specification.

GENERAL POST OFFICE.
40,000 "Osram" 4-volt telephone switchboard lamps.—General Electric Co., Ltd.

Lowestoft.—Electricity Committee.
Switchgear equipment in connection with the bulk supply of electricity from Great Yarmouth :—

Ferguson, Pailin, Ltd.	£21,532
English Electric Co., Ltd.	21,433
Metropolitan-Vickers Electrical Co., Ltd.	21,383
General Electric Co., Ltd.	21,417
British Thomson-Houston Co., Ltd. (incomplete).	
A. Reyrolle & Co., Ltd. (Accepted.)	**19,861**

Marlborough.—Town Council. Accepted:—
Constructing overhead electricity lines from Bath Road to Manton.—John Collier & Co., Ltd.

Middlesbrough.—Corporation. Accepted:—
3,000 yards of h.p. cable to complete the network (£2,325).—Macintosh Cable Co., Ltd.
Eight switches for the central sub-station (£457).—General Electric Co., Ltd.

Portsmouth.—Tramways Committee. Recommended:—
24 steel car axles (£89) and 100 steel tramcar tires (£270).—J. Baker & Co.

Electricity Committee. Recommended :—
H.p. cable for Lee-on-Solent extension :—6,000 yd. 0.04 sq. in., 11,000 yd. 0.06 sq. in., 3,000 yd. 0.06 sq. in., and 1,000 yd. 0.0225 sq. in. :—

Johnson & Phillips, Ltd. (Recommended.)	**£12,054**
British Insulated Cables, Ltd.	12,531
Callender's Cable and Construction Co., Ltd.	12,285
Pirelli-General Cable Works, Ltd.	12,252
W. T. Henley's Telegraph Works Co., Ltd.	12,562

1,580 yards of .15 sq. in. twin l.p. cable :—

Johnson & Phillips, Ltd. (Recommended.)	**£624**
W. T. Henley's Telegraph Works Co., Ltd.	638
British Insulated Cables, Ltd.	645
W. T. Glover & Co., Ltd.	651

Two 200-kVA transformers :—

English Electric Co., Ltd. (Recommended.)	**£307**
Hackbridge Electric Construction Co., Ltd.	318
British Electric Transformer Co., Ltd.	331
Johnson & Phillips, Ltd.	362
Metropolitan-Vickers Electrical Co., Ltd.	366
General Electric Co., Ltd.	380
Bruce Peebles & Co., Ltd.	380

Shrewsbury.—Baths Committee. Accepted:—
Rewiring at the swimming baths (£21).—G. H. Smallwood and Co.

South Africa.—PRETORIA.—Union Tender Board.
Telephone cable for the Posts and Telegraphs Department (Tender No. 81).—J. C. Ferguson, Connollys (Blackley), Ltd., J. Jeppe.—*S.A. Mining and Engineering Journal.*

Wakefield.—Electricity Committee. Accepted :—
Cross type marine boiler, &c. (£7,504).—Babcock & Wilcox, Ltd.
Tube economiser (£1,946).—E. Green & Son.
Housing Committee. Accepted :—
Wiring 20 houses, Snapethorpe Estate (£120).—J. E. Fowler.

Forthcoming Events.

Salford Technical and Engineering Association.—Monday, December 26th. Royal Technical College. 6.15 p.m. to 1.30 a.m. Annual social.

Royal Institution of Great Britain (Juvenile Christmas Lectures).—Thursday, December 29th, and Saturday, December 31st, &c.—31, Albemarle Street. 3 p.m. "Engines." Prof. E. N. da C. Andrade.

Electrical Power Engineers' Association (Southern Division).—Friday, December 30th. Institution of Electrical Engineers, Victoria Embankment. 7 p.m. Exhibition of a film of "The Babcock & Wilcox Boiler," described by Mr. J. K. Muir.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following :—

RIVAL hair dryers.
SUPER ELECTRIC carpet sweepers.
We also have a request for the address of the HELO SIGN CO.

Notes.

Birmingham Electric Club.

The report and balance sheet for the 23rd session of the Birmingham Electric Club shows that the progress which the club made during the 21st session has been more than maintained. The statement of accounts for the session shows a total revenue of £251 and a balance of £166. Thirty-three new members were elected during the period under review, and the report records the passing of three of the oldest members of the club, Messrs. E. A. Morgan, E. A. Whitehouse, and R. J. Richardson. The last mentioned was one of the founder members. The lectures delivered during the session were all of a high standard and well attended.

An Automatic Railway Gate.

Trials made recently by the Swedish Royal Board of Roads and Waterways on a new electrically operated automatic railway-crossing gate which, according to *Commerce Reports*, has been installed near Stockholm, have proved so satisfactory that the Board has petitioned the Swedish Government to give its approval. The gate, an invention of a Swedish engineer, Mr. Westfelt, is a simple one-bar, lift-up equipment, the bar being hinged vertically at a pillar which houses the operating motor and supply battery. At a given distance from the gate, on either side, insulation strips are placed between the rail joints, and the rails between the strips form part of the control circuit which is completed by the wheels, engine and cars of an approaching train as soon as the front wheels pass over the insulation. In addition to the control and operating equipment, various visual and aural signals are included for the drivers on both the road and the track. As soon as the train has passed the bars rise again to the vertical position.

B.E.S.A. Publication.

A revised edition of British Standard Specification No. 32, for Steel Bars for the Production of Machined Parts (suitable for Automatic, Semi-Automatic and Turret Lathes), has just been issued by the British Engineering Standards Association, and the following are the principal alterations embodied in it:—The Bessemer basic process for the manufacture of the steel has been eliminated and the electric process has been included; a minimum carbon content has been specified for grades 1 and 2 steels and omitted from grade 3 (free cutting) steel; the minimum tensile strength of grade 3 steel has been reduced to 28 tons per sq. in. for bright bars, and to 26 tons per sq. in. for other finishes, and in all three grades provision has been made for the higher percentage elongations obtainable from other than cold rolled and drawn bars; round bars above 5 in. in diameter and square bars above 5 in. in width across the flats have been standardised in definite steps of ¼ in.; bright hexagon bars corresponding to Nos. 1, 2, 3 and 4 B.A. bolt sizes have been included, and the hexagon bars corresponding to 13/16 in., 15/16 in., and 1¼ in. bolt sizes have been omitted, as these three sizes are no longer included in the British standard Whitworth and British standard fine screw thread tables.

It has not been found practicable to include standard tolerances for the black bars in view of the differing purposes for which the bars are used, *e.g.*, tolerances which are commercially suitable for bars for the direct production of machined parts are regarded as too wide for the production of bright drawn bars from the black rolled material. For a similar reason standard tolerances for blue bars have been omitted.

Copies of this revised Specification (No. 32-1927) may be obtained from the B.E.S.A. Publications Dept., 28, Victoria Street, London, S.W.1, price 2s. 2d. post free.

Emergency Drive of Woollen Mill.

An interesting example of the facility with which the electric drive can be adopted in a case of emergency is reported by the Yorkshire Electric Power Company. In November last a mill engine failed through the fracture of the piston and damage to the cylinder cover, and within less than 36 hours

Slip-ring Motor, 200 h.p. at 580 r.p.m., Driving Main Shaft.

the mill was running from the company's supply. The whole of the installation of the electrical equipment, including the provision of 550 h.p. of motors, was carried out by the Power Company, in addition to the work involved in making the supply available. The accompanying illustration shows the motor installed to drive the main shaft.

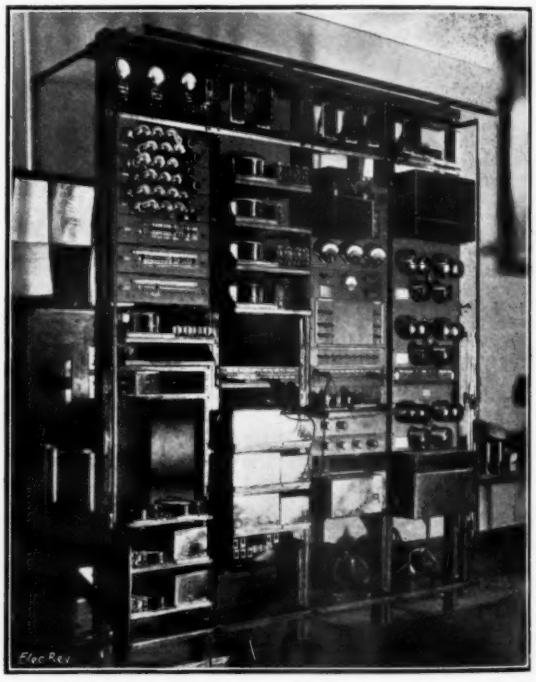
High-Frequency Flashes of Light.

At the monthly meeting of the Optical Society on December 8th, at the Imperial College of Science, a demonstration was given of the high-frequency interruption of light by a piezo-electric quartz crystal, by Mr. S. J. Underhill, of Messrs. Adam Hilger, Limited. This experimental apparatus was made at the suggestion of Professor Kerr Grant.

A beam of light was made to fluctuate in intensity at radio frequency in synchronism with the piezo-electric oscillations of a quartz crystal. The crystal was mounted between crossed Nicol prisms, so that when stressed it enabled a pencil of light to pass through the system from a carbon arc. It was maintained in vibration by a valve, and the transmitted light pencil, narrowed by a slit after leaving the crystal, fell upon a mirror which rotated at 132 revolutions per second. The streak of light thus produced on a cylindrical translucent screen surrounding the drum was found to be divided into bands 1.5 mm. apart, and from these data the frequency of the light beam was calculated as 168,800 cycles per sec., or approximately double the frequency (84,500 cycles per sec.) of the crystal as measured by an absorption frequency meter.

A 1,300-mile Private Telephone.

A private telephone "line" which is unaffected by Aurora Borealis, storms, or floods, was inaugurated on November 9th between the Head Office of the Canadian National Railways at Montreal and the Western Divisional Headquarters at Winnipeg, over 1,300 miles away. This new long-distance circuit forms part of a carrier-current telegraph system which has also just been opened by the Canadian National Railways between the two cities and has the distinction of being the longest "office 'phone" in Canada. Its operation will permit officials of the company to converse directly with their officers half a continent away without being subjected to the inconvenience of passing the calls through a number of private exchanges and intermediate relaying stations; before its installation, calls from the head office of the Canadian National Railways to the Winnipeg office had to pass through Chicago and St. Paul, causing delay. The telephone messages are transmitted over the same wires as convey telegraph messages in the morse code and 18 messages, in addition to the telephone message, can be sent over the same wires at the same time. This system of telegraphy is being introduced in Canada by the Canadian National Railways in order to overcome many



Telephone Repeater at Hornepayne, Ont.

of the technical difficulties to which ordinary telegraph lines are subjected in a country of such great distances. The carrier-current system is based on the radio principle, each message being guided along the wires in the form of electric waves of specific length instead of being broadcast into space in all directions. The messages are picked up at the other end of the line by receiving apparatus by means of which the operator may tune in to whichever message he desires to pick up, and a characteristic of the method is the fact that it is virtually unaffected by conditions which ordinarily throw out of commission the older telegraph system. Experiments have proved that earth currents have no effect whatever and that poles and wires may be completely submerged without affecting the transmission of messages in any way; one experiment consisted of breaking one of the wires, in spite of which it was possible to use the line successfully. The accompanying illustration shows one of the seven telephone repeater stations used on the system between Toronto and Winnipeg.

Electricity on Poultry Farms.

Mr. C. H. Dobbin, of the Lancashire County Council farm, gave an instructive address on "Farm Poultry Keeping" at Burnley a few days ago, when he spoke of the value of electric light as a factor in egg production. As a result of experiments, he said, they obtained from 125 birds in an artificially-lighted section 1,118 more eggs in four months than were given by the same number of birds kept on the dark side of the house. Both lots received the same quantities of food and the increased production of the artificially-lighted pen represented an extra profit for the four months of 1s. 9d. per bird. It had been suggested that the birds on the lighted side of the house should have been given a larger quantity of food than those on the dark side, but his reply was that, if he had done so, it would not have been a fair experiment. As to the lighting of houses, he did not think there was any necessity to light beyond three hours. He knew one person who used light for only half an hour and got excellent results.

An Arc-Welded Bridge.

What is described as the first completed all-welded railroad bridge in the world spans the historic creek on the Turtle Creek-Linhart branch of the Westinghouse Electric and Manufacturing Company's interworks railroad, U.S.A. The bridge, which is 62 feet long and contains only 20 tons of steel, is constructed of smooth continuous girders joined by arc welding, and it is claimed that the saving in weight by the absence of riveting amounts to from 25 to 30 tons. Preliminary to the actual raising of the bridge the huge girders were welded in the shops and made all ready to lay. The old bridge was then lifted from its foundations, the new girders placed, all members welded and the tracks laid. These operations were accomplished in one day and a half, four arc welders being employed for the work. The one-piece bridge will be subjected to the most exacting tonnage tests, as it was designed to carry the largest generators built at East Pittsburgh. The bridge was designed and built by the Westinghouse Works Engineering and Maintenance Department.

Appointments Vacant.

Divisional engineer (£600) for the Ceylon Government Posts and Telegraphs Department. Electrical engineer (£400) for the Urban District Council of Cleethorpes. Showroom assistant (£200+) for the Barking U.D.C. Electricity Department. Assistant mains engineer (£314) for the Borough of Wigan Electricity Department. (See our advertisement pages to-day.)

Canadian Hydro-Electric Development.

The report of the Water Power Branch of the Canadian Department of the Interior treats of the importance of water-power in Canadian development. Its influence on the trend and expansion of industry has already become evident to a remarkable degree, and the Dominion's continued progress as a manufacturing country of the first importance is assured by the abundance of low-priced power afforded by these great resources. Cheap power, it is claimed, has been an important factor in the establishment in the Dominion of 1,400 branch factories from the United States. It has made the coalless provinces of Quebec and Ontario great industrial provinces, and has permitted successful competition against mass production in other countries. It is estimated that Canada has under ordinary minimum flow 20,197,000 h.p., and of power ordinarily available for six months of the year 33,113,000 h.p. Of this huge potential water power there has been developed only 4,888,266 h.p., mostly in Ontario and Quebec. Power estimated by provinces is as follows:—

Province.	Possible power. h.p.	Power developed. h.p.
British Columbia	5,108,500	473,062
Alberta	1,047,500	34,107
Saskatchewan	1,082,000	35,000
Manitoba	5,344,500	255,125
Ontario	6,940,000	1,827,088
Quebec	13,064,000	2,165,443
New Brunswick	120,000	47,241
Nova Scotia	128,300	65,702
Prince Edward Island ...	5,300	2,274
Yukon and Northwest Terr....	275,300	13,199
Total ...	33,113,200	4,883,266

The amount of capital invested in Canadian water power is placed at $900,000,000, or more than that of any other single manufacturing industry. In 1910 the investment was $121,000,000, so that the increase in the seventeen years has been over 600 per cent. During the past three years the capital invested in new water-power developments has been $180,000,000. In 1923 the estimates of the percentage of Canadian and foreign capital in this industry was: Canadian 66.9 per cent., Great Britain 6.3 per cent., the United States 15 per cent., and other countries 11.8 per cent. With the extensive programme of construction now under way, and the large number of developments in early prospect, there is every reason to believe that the progress of recent years will be well sustained. In the development of mining and the pulp and paper industries cheap water power has been the most important factor. The total amount of electrical energy used in the pulp and paper industry is estimated at 1,358,052. In the mining industry cheap power has made possible development on the present scale, as owing to the geographical situation of the mining areas, the use of coal for developing power would have been prohibitive.

Storage as a Guarantee of Continuity of Supply.

Whilst going to press we have received the following letter:—

Mr. Chattock's letter in your last issue directs further attention to what is becoming more and more a vital question with the consumer of electricity. Recently there have been several instances of failure in supply over areas both large and small, where business has been brought to a standstill for periods which are usually at the busiest time of the day.

Continuity of supply from a single source cannot be absolutely guaranteed, as is generally recognised by local authorities who are responsible for the granting of licences for places of public entertainment. An alternative supply is essential in such cases, and it must be evident to those responsible for large shops and hospitals that the risk of loss in the one case of business and actual goods and in the other of human life is too great for dependence to be placed on one source. Apart from inconvenience and loss, the danger of panic in large buildings necessitates the provision of an alternative supply to meet emergencies such as these. One cannot build a house without a water cistern, notwithstanding the reliability of the supply, and light and power are now becoming as necessary as water. The installation of a storage battery of suitable capacity which can be charged from the mains is an insurance against such risks which rapidly justifies itself. This was proved during the recent stoppages in the case of institutions where such batteries had already been installed.

However small the area affected, the risks are individually the same, and where the public are concerned they cannot be ignored.

D. C. McLagan,
Secretary, Accumulator Makers' Association.

London, *December 19th*, 1927.

A Novel Musical Invention.

Prof. Léon Theremin, a young Russian scientist, recently demonstrated in Paris apparatus which produces music by means of electrical oscillations and can be controlled and made to play a given piece merely by moving the hands to and fro near the instrument. Users of valve sets for wireless telephony are familiar with the phenomenon of "howling," which occurs as the result of electrical oscillations under certain conditions and also of the fact that the strength and tone of signals are affected when an object, such as the listener's hand, is thrust into the magnetic field of the instrument. Prof. Theremin's apparatus depends, says *The Times*, upon these phenomena: "By means of apparatus similar to that used in wireless telephony he changes the normal alternations of the electric lighting mains into oscillations at "musical" rates of 200 to 6,000 per second," which are conveyed to his audience by loud-speakers. The magnetic field is concentrated around two conductors; one a vertical rod on the right of the instrument, the other a loop of wire on the left. By moving his right hand up and down in the air beside the rod M. Theremin varies the pitch of his music, and by moving his left hand to and fro over the loop he controls its volume. The general effect is that of the violin, but the ton is alleged to be more pure. The degree of elaboration depends upon the skill of the player. Schubert's *Ave Maria*, Offenbach's *Musette*, Saint-Saëns's *Le Cygne*, Rubinstein's *Night*, and other pieces, accompanied by a pianist, were played with surprising success and enthusiastically applauded.

Prof. Theremin demonstrated his instrument privately at the Savoy Hotel, London, on December 10th and publicly at the Albert Hall on December 11th, prior to his departure for America on December 12th. The sounds produced are amplified and emitted by a loud-speaker.

The Singapore Electricity Undertaking.

The opening of the St. James power station by Sir Hugh Clifford, G.C.M.G., in November marked an important point in the history of electricity supply in the Island of Singapore. The first supply of electricity to the city was provided by the Municipal Commissioners in 1905, when a supply was taken from the Singapore Electric Tramways Co., which remained the source of supply up to the time the new station was established. In 1923, the Commissioners instructed Messrs. Preece, Cardew & Rider, consulting engineers, to choose the site and advise and prepare plans and specifications for a power station, the ultimate result being the station in question. The site at St. James has an area of about five acres, and is served by an unlimited quantity of water for condensing purposes. Sea-borne coal can be delivered within a few yards of the station, and a connection with the F.M.S. Railways also provides for the delivery of locally-mined coal and for the transport of materials and plant. The building is a steel-framed structure supported or reinforced-concrete piles. Accommodation for 4,000 tons of coal is provided and narrow-gauge trucks run between the coal heaps and along the quay wall to the coal elevator. The boiler house is 120 feet long by 88 feet wide, and is designed for two rows of four boilers with a central firing gangway. Six boilers have so far been erected. Each boiler will evaporate 40,000 lb. of water per hour at a pressure of 250 lb. per sq. in., superheated to a temperature of 650 deg. F. The boiler furnaces are worked on the balanced draught system with atmospheric pressure above the fire. Oil burners have been installed on all the boilers, together with the necessary pumps and heaters for delivering the oil under pressure and at the correct temperature for combustion in the boiler furnaces. The present turbine room is 120 feet long by 59 feet wide and contains three main turbo-alternators, two of 5,000-kW capacity each, and one of 2,000 kW. An auxiliary geared turbo-alternator, 120 kW, is also installed. The main system is 3-phase, 6,600 V, 50 cycles. The auxiliary turbo-alternator delivers at 400 V, 3-phase, and will be used to start up the auxiliary motors of either of the main turbines in the event of a total shut down of the plant. A storage battery is installed for the emergency lighting of the station and for operating the e.h.p. switchgear and signal lamps.

The e.h.p. switchgear is electrically remotely controlled and of the armour-clad compound-filled type, duplicate busbars being provided for the alternator and feeder circuits.

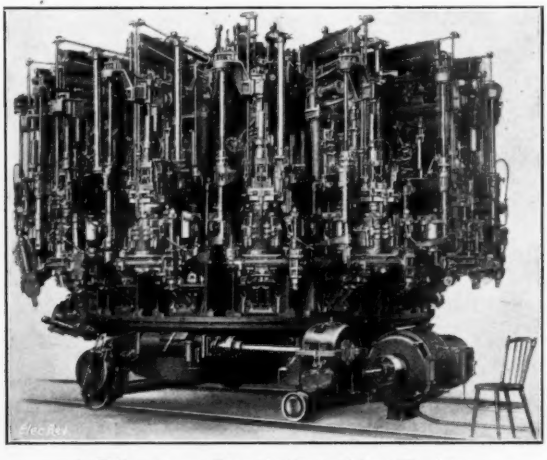
The transmission system has been laid and the sub-stations designed and equipped by the municipal electrical engineer, Mr. E. W. P. Fulcher, M.B.E. Energy is transmitted from the power station at the generating pressure by underground cables to the distributing sub-stations.

Volta Memorial Fellowship.

A fund of $25,000 (the income from which will be applied each year to post-graduate work in an American university of an electrical engineer from Italy) has been established by individuals, associations and corporations in the United States who are interested in electrical development, it has been announced by the Italy American Society. The fund has been raised to mark the one hundredth anniversary of the death of Alessandro Volta, and the student who will go to the United States will be selected competitively by the Associazione Elettrotecnica Italiana. In the United States the administration of the fellowship is in the hands of the Italy American Society.

Glass-Bottle-Making Machines.

A remarkable piece of engineering work, unusual for an electrical manufacturing company, was recently completed by the construction of two large highly complicated machines for making glass bottles. Prior to 1920 the supply of bottle-making machinery was almost a complete American monopoly, but Mr. F. Redfern, a solicitor by profession who had had no previous experience of machine construction, primarily in order to meet the needs of Messrs. John Walker & Sons, Ltd., of which firm he is a director, with the assistance of Mr. R. F. Hall (engineer), Mr. Sydney Hunt (designer), and the Metropolitan-Vickers Electrical Co., Ltd. (constructor), has succeeded in producing a machine capable of making better bottles more cheaply than the best American equipment. The first model, a ten-unit machine, was installed in 1920 in the Castleford works of John Lumb & Co., Ltd., a subsidiary undertaking of John Walker and Sons, Ltd. The two new machines, one of which is illustrated below, are of improved design and greater capacity, supplied for the Mitsubishi Shoji Kaisha, of Japan. They are 17 feet in diameter and 15 feet in height; revolving about the central column are fifteen units, each of which constitutes a complete bottle-making machine, which are rotated alongside a pot of molten glass: as each passes it takes up a sufficient quantity of glass to make a bottle, and each makes one bottle per revolution when single moulds are used. At the maximum speed of 6 r.p.m., each machine can thus produce 90 large bottles per minute and maintain an output of over 5,000 bottles per hour; with dual and triple moulds smaller bottles can be produced at correspondingly greater rates, and the bottles may range from 2½ to 16 inches in diameter; with the present equipment bottles of fifteen different shapes and ten different capacities may be manufactured simultaneously by each machine. It is driven by a 15-h.p. motor operating through a 2-speed gear-box and worm gearing on the rotating base; the speed can be varied from 1¼ to 6 r.p.m. and the drive to the operating parts of each arm is transmitted mainly through cams and levers, the operation of the whole machine being, apart from the main drive, entirely automatic. The machine can be traversed to and from the pot either by motor



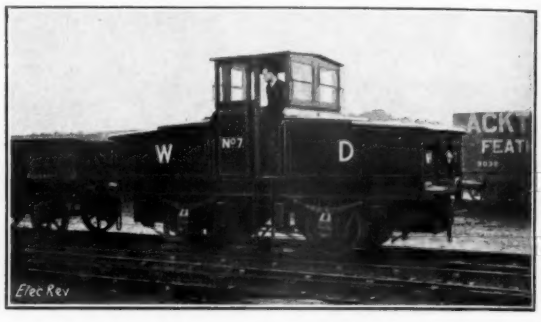
A Fifteen-arm Glass-bottle-making Machine.

or by hand gear, and it can be raised and lowered to suit different levels of glass in the pot by means of a 2½-h.p. motor.

The construction of such machinery as this requires the finest machine-tool equipment, and the highest quality materials and workmanship; not only has each machine to carry its own rotating weight of about 40 tons with absolute rigidity, so as to ensure accurate registration of moulds and other operating parts, but it has also to maintain its accuracy under severe conditions in continuous night and day operation.

A Large Battery Locomotive.

Some time ago we recorded the completion of a special electric rail car built by Messrs. Electromobile, Limited, which we understand is giving exceedingly good service. Preliminary trials have now been carried out of a large battery-driven locomotive which the company has made to the order of the War Office, and immediately after it was connected up (without preliminary "running in") the locomotive was set to work hauling a train of wagons totalling 250 tons, after which the wagons were shunted in twos and threes. We understand that it is one of the largest locomotives on two axles only; in running order it weighs fully 30 tons, and is equipped with two 60-h.p. low-speed motors directly connected to the axles by single-reduction spur gearing, giving a normal full-load speed of four miles per hour and a maximum draw-bar pull of 15,000 lb. The battery consists of 108 cells having a capacity of 800 ampere-hours at the five-hour rate. It is split up into 20 sections, each being fitted into a hard-wood tray which, in turn, is supported on porcelain insulators with a view to preventing leakage between cells. The controller had to be specially built for the large currents, and is of the series-parallel type with six series



An "Electromobile" Locomotive.

notches and four parallel ones, giving ten speeds and smooth acceleration. Rheostatic braking is also provided, with four notches; a hand brake is fitted and eight sand boxes.

E.A.W. Activities.

At a meeting of the Electrical Association for Women, held at the showrooms of the Kensington and Knightsbridge Electric Lighting Co., Ltd., on December 8th, Mrs. C. S. Pell, O.B.E., gave an interesting talk on the advantages of electricity in the home, and advocated that modern houses should be fitted with more "mechanical servants" as parts of the structure.

On December 14th Mr. W. E. Bush, manager, E.L.M.A. Lighting Service Bureau, London, addressed the South Wales and Monmouthshire Branch of the Association at Cardiff, on the "Principles of Good Lighting in the Home."

On December 14th a large party of members visited Touchbutton House, Newman Street, London, and was received by Mr. H. H. Berry, who gave an interesting address on the "co-electric" system of heating. Mr. Berry traced the development of heating methods from early Norman times to the present day. Tea was prepared by Mrs. Mole in the up-to-date electric kitchen, and a vote of thanks to Mr. Berry was proposed by Lady Snell.

Light and Heat in Medicine, Surgery and Hygiene.

Last week, from December 13th to 16th, the first international conference on the subjects above-named was held at the Central Hall, Westminster. Papers were read on the properties and uses of ultra-violet radiation, visible light, and heat rays, public health work, optics and diseases of the eye, and other branches of actinotherapy, by eminent medical men and physicists—eighteen in all—which, it is hoped, will ultimately be published in book form.

An interesting exhibition of apparatus was arranged in the same building, to which the public were admitted. The usual types of "artificial sunlight" apparatus were shown on a large number of stands. An exceptionally fine exhibit was that of Messrs. Kelvin, Bottomley & Baird, Ltd., in conjunction with Messrs. Gallois et Cie. Other well-equipped stands were those of Messrs. Ajax, Ltd., the Cox-Cavendish Electrical Co. (1924), Ltd., Messrs. John Bell & Croyden, Ltd., the British Hanovia Quartz Lamp Co., Ltd., and Messrs. I. Calvete, Ltd.; the Chloride Electrical Storage Co., Ltd., showed a variety of accumulators, and the Hewittic Electric Co., Ltd., had a full range of u.v. lamps on view, as well as an ultraviolet-ray water steriliser, which can deal with 140 gallons of water per hour at a low cost. Other electrical exhibitors were Messrs. Rouse & Sons, Ltd., Amalgamated Photographic Manufacturers, Ltd. (therapeutic arc lamps), the B.I. Syndicate, Ltd., Messrs. Henrion Carbons, Ltd., Apex Sun-ray, Ltd., Carl Zeiss (London), Ltd., Betax Manufacturing Co., Ltd., the Thermal Syndicate, Ltd., Sun-vi-lite, Ltd., Electrical Equipment and Carbon Co., Ltd., Standard Ozone Co., Ltd., Dowsing Radiant Heat Co., Ltd., Westminster Engineering Co., Ltd., Clifford Therapeutics, Ltd., Messrs. Stanley Cox, Ltd., and Le Quartz Diamant.

Westfield College (University of London) had an exhibit showing the influence on plants of irradiation with a Hewittic quartz mercury vapour lamp, and the London Light Clinic had a stand. The exhibition and conference were organised by the *British Journal of Actinotherapy*.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

According to *Modern Transport* Mr. W. J. THORROWGOOD, who retired from the position of signal and telegraph superintendent, Southern Railway, on September 30th, was recently presented with a case of electrical measuring instruments, at Waterloo Station. The presentation was made by Mr. G. Ellson (chief engineer, S.R.). Mr. Thorrowgood was also presented with an album containing the names of subscribers.

It is announced in the Press that Mr. JOHN FERGUSON (a member of the firm of Sir Alexander Gibb and Partners) has been appointed a director of British Insulated Cables, Ltd.

Mr. E. HAMBLOCH has resigned his appointment as Commercial Secretary in Rio de Janeiro owing to ill-health. He is to be succeeded by Mr. S. G. Irving, at present British Consul at Lisbon.

Mr. T. R. SMITH, electrical engineer to the Corporation of Leicester for 27 years, has resigned. It is stated that he intends to practise as a consulting electrical engineer.

Lt.-Col. W. J. KENT, chairman of Messrs. Taylor, Tunnicliffe and Co., Ltd., insulator manufacturers, of Hanley and Longton, and chairman of Electric Transmission, Ltd., has been appointed a magistrate for Staffordshire.

Mr. C. R. C. HART, chairman and managing director of the Dermatine Co., Ltd., is recovering from his recent attack of pneumonia, and hopes to be fully restored to health in the New Year.

Mr. J. TAYLOR writes pointing out that his appointment at Walsall is junior mains engineer, not mains engineer as stated in our last issue.

At Bath on Friday night the staff and employés of the Corporation Electricity Department made a presentation to the chairman of the Committee, Ald. Sir HARRY HATT, J.P., on his completion of 25 years' chairmanship of the undertaking. The present consisted of a solid silver rose bowl and four vases and an illuminated album. Mr. P. R. Morris first proposed Sir Harry's health and Mr. E. Brown, one of the "Old Brigade," made the presentation.

To fill the post rendered vacant by the resignation of Mr. Rendell Baker, the St. Helens Electricity Committee has recommended the Council to confirm the appointment of Mr. R. LEE, of the Stockport Corporation Electricity Department, as borough electrical engineer.

Mr. GEORGE PEGG, who has been associated with Messrs. A. P. Lundberg & Sons for the past 35 years, has been appointed a director of A. P. Lundberg & Sons, Ltd.

The Council of the Physical Society has awarded the Duddell Medal for 1927 to Dr. F. E. SMITH, C.B., F.R.S., who in 1920 left the National Physical Laboratory to assume the position of Director of Scientific Research at the Admiralty.

The Electrical Association for Women held the last of its evening functions for women demonstrators and saleswomen on Wednesday, December 14th. It took the form of a social evening at 46, Kensington Court, when Mr. and Mrs. J. W. BEAUCHAMP were the guests of the evening. As a small expression of their appreciation of his help and interest in their work, the women demonstrators presented Mr. Beauchamp with a small set of books for his library.

St. Pancras Borough Council Parliamentary and General Purposes Committee recommends that a retiring allowance of £765 per annum be granted Mr. S. W. BAYNES, the chief electrical engineer, who is retiring at the end of the year.

Obituary.—MR. C. B. MANVILLE.—Mr. Charles B. Manville, founder of the Johns-Manville Corporation and a well-known pioneer in the manufacture of insulating materials, passed away at his home in Pleasantville, N.Y., on November 26th, at the advanced age of 96 years. For many years, as the *Electrical World* states, the company of which he was president was known as the H.W. Johns-Manville Company. Early this year its name was changed to that given above, but Mr. Manville had retired from active participation in 1902.

MR. T. FENDER.—Mr. Thomas Fender, who for some years was superintendent over the Vickers works at Barrow and was subsequently a director of Vickers, Ltd., passed away on December 14th at the age of 63 years.

M. H. ETIENNE.—A *Reuter* dispatch states that M. Henri Etienne, director of the International Bureau of the Telegraphic Union, has died of angina pectoris on the ship on which he was returning to Europe from the recent International Wireless Conference in Washington.

MR. E. T. RUTHVEN-MURRAY.—The death occurred on Friday last, December 16th, at Sherwood, Radlett, of Mr. Ethelbert Thomas Ruthven-Murray, son of the late Sir James Murray, of Oxford. Mr. Murray was in his 58th year. He was on the engineering staff of J. E. H. Gordon & Co., Ltd., in 1892, erecting public electricity works in England and Ireland, and in the following year he left the position of resident electrical engineer at Larne to take up the post of city electrical engineer of Aberdeen under Prof. (now Sir Alex.) Kennedy. He subsequently occupied similar positions at Worcester and Willesden. The Willesden Council sold its undertaking to the North Metropolitan Electric Power Supply Co. in 1904, and Mr. Ruthven-Murray occupied important posts under that company and the North Metropolitan Electrical Power Distribution Co., Ltd., for many years. He read a paper before the I.M.E.A. in 1902 and was a member of the Institutions of Electrical and Mechanical Engineers. The funeral was to take place at Radlett on Wednesday.

Wills.—MR. ELIOT HOWARD, chairman of Hayward-Tyler and Co., left £27,437 gross and £20,349 net personalty.

The late Sir GERALD ALBERT MUNTZ, Bart, F.R.S., managing director for many years of Muntz's Metal Co. and an ex-president of the Institute of Metals, left £12,785 gross and £11,253 net personalty.

The late Sir WM. GALLOWAY, D.Sc., a former president of the South Wales Institute of Engineers, left £5,972 gross and £5,729 net personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Portable Wireless, Ltd.—Private company. Registered December 12th. Capital, £500 in £1 shares. Objects:—To carry on the business of distributors and relayers of radio television and/or other programmes, radio engineers and manufacturers, &c. The subscribers (each with one share) are:—E. McBean, 7, Avignon Road, Brockley, S.E.4, solicitor's clerk; and J. G. Angold, 2, Dacre Gardens, Lee, S.E.13, solicitor's managing clerk. The first directors are to be appointed by the subscribers. Secretary (*pro tem.*): W. G. Curtis. Registered office: Triumph House, 189, Regent Street, W.1.

Switchgear and Electrical Equipment Co. (Glasgow), Ltd.—Private company. Registered in Edinburgh December 14th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of and agents for switchgears and electrical machinery, electricians, engineers and designers, &c. The first directors are:—J. R. Small, 177, West Regent Street, Glasgow, electrical engineer; W. Fraser, 18, Trinity Road, Knightswood, Glasgow, electrical engineer. Registered office: 177, West Regent Street, Glasgow.

Dur-A Electric Lamps, Ltd.—Private company. Registered December 13th. Capital, £1,500 in 1,150 ordinary shares of £1 each and 1,400 ordinary shares of 5s. each. Objects: To carry on the business of electric lamp importers, merchants, and general commission agents, &c. The subscribers are:—H. Smith, "Pyndan," Church Fenton, Leeds, manufacturers' agent, four 5s. shares; J. McCutcheon, 4, Rownsley Street, Leeds, clerk, one £1 share. H. Smith is the first permanent director. Qualification: £1.

Lambert & Whistlecroft, Ltd.—Private company. Registered December 14th. Capital, £500 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in wireless telegraph instruments and all accessories, &c. The directors are: E. Lambert, 15, Gloucester Place, Brighton; E. V. Whistlecroft, 5, New Road, Oundle, Northants. Qualification: £100 shares or stock. Registered office: 3, Old Steine, Brighton.

Camille Espir, Ltd.—Private company. Registered December 14th. Capital, £2,000 in £1 shares. Objects: To acquire the business of a manufacturer and importer of electrical accessories carried on by Camille Espir at 19, Hanover Square, W., and to carry on the same and the business of mechanical, electrical, motor, automobile, lighting and general engineers, &c. The permanent directors are: Camille Espir, 19, Hanover Square, W.; C. Shears, 244, Coombe Lane, Wimbledon, S.W. Qualification: £200 shares. Secretary: C. Shears. Registered office: 19, Hanover Square, W.1.

Mohawk Radio, Ltd.—Private company. Registered December 10th. Capital, £1,000 in £1 shares. Objects:—To acquire the business of a wireless manufacturer, &c., hitherto carried on by T. O. Peet, trading as "Mohawk Radio," at 252, Fratton Road, Portsmouth, Hants. The subscribers (each with one share) are:—T. O. Peet, "Cranleigh," Mayfield Road, Portsmouth, wireless manufacturer; Mrs. M. Peet, "Cranleigh," Mayfield Road, Portsmouth. T. O. Peet shall be permanent governing director so long as he holds 500 shares. Secretary: J. S. Wood. Registered office: 252, Fratton Road, Portsmouth.

Buell Combustion (Foreign), Ltd.—Public company. Registered December 16th, with a nominal capital of £165,000 in £1 shares (100,000 ordinary and 65,000 deferred). Objects: To acquire from the Buell Combustion Co., Ltd., certain inventions for exploitation abroad and the foreign patents taken out or to be taken out in respect of such inventions and/or licences to work these in relation to systems of combustion or burning of pulverised fuel known as "The Buell System," and in relation to the systems of grinding, crushing and pulverising known as "K.E.K. Mill," and "W.A.C. Pulveriser," and to carry on the business of iron and brassfounders, mechanical, electrical, and other engineers, &c. The minimum cash subscription is 7 shares. The subscribers (each with one share) are:—E. J. Burrows, 29, Lyndhurst Road, Highams Park, Chingford, E.4, solicitor's clerk; T. G. Greenleaf, 36, Sistova Road, Balham, S.W.12, solicitor's clerk; and five others. The first directors are to be appointed by the subscribers. Qualification: £500 shares or stock. Remuneration: £150 each per annum. Solicitors: Herbert Smith & Co., 62, London Wall, E.C.2.

A.B.C. Daylight and Electric Signs, Ltd.—Public company. Registered December 14th. Capital, £500 in 400 preference shares of £1 each and 2,000 ordinary shares of 1s. each. Objects: To adopt an agreement between J. W. Mander of the first part, Aston & Mander (1917), Ltd., of the second part, and this company of the third part, to develop and turn to account the patents and rights referred to therein, and to carry on the business of manufacturers of and dealers in advertising or other signs and electrical or other apparatus in connection therewith, &c. The directors are:—Mrs. S. A. Mander, The Nayland, 5, Canterbury Road, Margate; W. L. Dowton, The Nook, Beckenham Road, West Wickham, architect; J. W. Mander, 90, Dames Road, Forest Gate, mathematical instrument maker. Registered without articles of association. Secretary: Miss Florence A. Symons, 63, Galloway Road, W.12. Registered office: 63, Old Compton Street, W.1.

Electric Ignition Laboratory, Ltd.—Private company. Registered December 16th. Capital, £2,000 in £1 shares. Objects: To acquire the business of H. J. Andrew, carried on by him at 63, Union Street, Oldham, as the Electric Ignition Laboratory, and to carry on the business of manufacturers and repairers of and dealers in magnetos, ignition coils, accumulators, electric motors, and generators, radio and other electrical apparatus, &c. The subscribers (each with 10 shares) are:—H. J. Andrew, 63, Union Street, Oldham, engineer; Mrs. R. Andrew, 63, Union Street, Oldham; Miss D. M. Taylor, 271, Park Road, Oldham. The first directors (to number not fewer than two or more than five) are H. J. Andrew (life managing director) and Mrs. R. Andrew. Solicitor: D. E. Griffiths, Clegg Street, Oldham.

Official Returns of Electrical Companies.

Skegness Electricity Supply Co., Ltd.—A. Hardie, of Bardoola, Finchley, N., was appointed receiver on November 29th, 1927, under powers contained in debentures dated November 23rd, 1923.

W. P. T., Ltd.—Capital, £150 in £1 shares. Return dated December 31st, 1926 (filed May 19th, 1927). Two shares taken up. £2 paid. Mortgages and charges, nil.

Ellesmere Port Electrical Co., Ltd.—Capital, £500 in £1 shares. Return dated June 22nd, 1927. 350 shares taken up. £201 paid, £149 considered as paid. Mortgages and charges, nil.

Local Factors, Ltd. (formerly Traggoh Lamp Co., Ltd.).—Capital, £1,000 in £1 shares. Return dated December 31st, 1926 (filed May 30th, 1927). All shares taken up. £1,000 paid. Mortgages and charges: £500.

Illuminated Advertising Co., Ltd.—Particulars filed of £1,000 debentures authorised December 1st, 1927, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued

Budleigh Salterton Electric Light and Power Co., Ltd.—Debenture dated December 2nd, 1927, to secure £2,000, charged on land at Budleigh Salterton and the company's undertaking and property, present and future, including uncalled capital. Holders: Branch Nominees, Ltd., 15, Bishopsgate, E.C.2.

Stensigns, Ltd. (old company).—A. B. Burbridge, of 41, Charing Cross Road, W.C.2, ceased to act as receiver and manager on December 5th, 1927.

Halesowen Lighting and Traction Co., Ltd.—Debenture dated December 2nd, 1927, to secure £11,500, charged on the company's undertaking and property, present and future, including uncalled capital (if any). Holders: Shropshire, Worcestershire & Staffordshire Electric Power Company, 88, Kingsway, W.C.2.

Smith & Sturt, Ltd.—Debenture dated December 2nd, 1927, to secure £350, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: P. Forrester, Ballochmyle, Blundellsands, Lancs.

Hungerford and District Electricity Supply Co., Ltd.—Debenture dated November 25th, 1927, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder:—Amanda G. Mason, 82, Albert Hall Mansions, W.

A. P. Lundberg & Sons, Ltd.—Particulars filed of £10,000 debentures authorised December 2nd, 1927, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Milford-on-Sea Electric Supply Co., Ltd.—Satisfaction in full on December 3rd, 1927, of debentures dated April 29th, 1921, securing £400.

City Notes.

Aluminium Corporation, Ltd.

The annual meeting was held on December 16th. Mr. S. G. Bibby presided, and in presenting the report and accounts (*vide* our last issue, p. 1048), said that it was difficult for the shareholders to realise the difficulties which had been surmounted during the year. Owing to the Eigiau Dam disaster in November, 1925, they started the year with the works out of commission, and they were thus able to deal with only a small portion of their business at a heavy additional cost. After a great deal of trouble, they were able to dry out the generating plant and put it into operation again. The works had to be cleared of *débris* and the furnaces rebuilt, and while that was being done the rainy season had passed and the benefit of the major portion of the year's rainfall was lost. The rolling mill, although seriously damaged, suffered least, and by buying metal at the full market price, they were able to supply sheets and circles to their customers. In spite of their difficulties they had managed to make a net profit sufficient to cover the first debenture interest. Sir Robert McAlpine and the chairman (Mr. K. M. Clark) provided cash to meet the extraordinary expenses. The chairman also arranged to purchase the whole of the "B" debentures, at the same time obtaining an agreement postponing the payment of interest on the "B" and "C" debentures for a period during which it was hoped to bring the company to a profitable stage. The Norwegian factory had been established, and the company as sole selling agents had already received first deliveries of metal. By that means they had provided for the full use of their alumina and electrode plant, and had secured an ample supply of metal, at a competitive price, for their rolling mills. The report and accounts were unanimously adopted.

Barbados Electric Supply Corporation, Ltd.

The report for the year ended June 30th shows a trading profit of £12,836, as compared with £11,004. After meeting London expenses, debenture interest, &c., and adding £1,957 brought forward, there remains £11,212. Of this amount £6,000 has been transferred to depreciation and renewals reserve; £2,017 has been written off debenture issue expenses; £1,000 is set aside for debenture redemption; and £2,195 is carried forward. The period of the outstanding £18,000 6 per cent. debentures has been extended to 1947 and a further £2,000 was issued to cover the renewal commission of 10 per cent. The number of consumers connected rose from 3,344 to 3,541, and the sales of energy from 566,334 to 642,765 kWh. The directors are considering a scheme to encourage the extended use of electricity by existing consumers. No additions were made to the generating plant during the year, but ample space is available. The directors propose to reorganise the capital, having in view the satisfaction of the holders of the preferred shares while preserving some equity for the ordinary shareholders. It is felt that the continued expansion of the business justifies the hope that it will be possible to pay a dividend upon the reorganised capital. The meeting was held on Tuesday last.

Associated Electric Co.

This company was formed in March of last year, for the purpose of refunding and consolidating the indebtedness of the Associated Gas and Electric Company and certain of its subsidiary and affiliated companies. *The Times* states that the first report of the company, covering the year 1926, states that during that period there was expended for additions and improvements to the properties of companies controlled or operated by the Associated Electric Company $6,553,385. The condensed consolidated income account, including income for companies

acquired during the year, only from approximate date of acquisition to December 31st, 1926, shows total operating revenues of $20,442,206, while gross income, including other income, and after meeting operating expenses, maintenance, and taxes, was $10,787,169. The balance, after paying fixed charges and other deductions and interest on funded debt, was $6,261,559. Provision for retirements, renewals, and replacements amounted to $1,317,997, leaving $4,943,562 as the amount available for Federal income-taxes, dividends, and surplus.

Associated Gas and Electric Co.

The report for the year ended December 31st, 1926, records net earnings of $13,761,310, and a net income, after providing for loan interest, &c., of $5,494,419. After providing for replacements and renewals, preferred stock dividend, and Class "A" priority dividend ($2 per share), $1,597,312 remains for other dividends and surplus.

Southern Brazil Electric Co., Ltd.

The income from Brazilian investments for the year ended December 31st last decreased from £43,800 to £32,030 owing to a fall in exchange. The net profit rose from £334 to £390. A year's arrears of interest on the debentures has been paid, together with the current interest, bringing service up to date. Certain heavy liabilities were paid off from the proceeds of an issue of £200,000 7 per cent. prior lien bonds made during the year. The balance of the proceeds is being used for extensions, which are now in progress. The debenture holders agreed to the issue on consideration of the interest of their bonds being raised from 6 to 6½ per cent. The improvement in Brazilian conditions has been more gradual than was expected, but the directors feel assured of continued progress, and look to a more prosperous future for the company. The meeting was to be held on Wednesday last.

Ceara Tramway, Light and Power Co., Ltd.

The gross receipts for the year ended June 30th last rose from milreis 2,669 : 059 $542 to milreis 3,031 : 506 $056, and the net receipts from milreis 1,043 : 914 $875 to milreis 1,204 : 131 $006. Full benefit was received from the increased fares which came into operation in 1925. The rise in currency receipts was largely negatived by the fall in exchange. The net revenue was £28,536, and to it was added £4,204, making £32,740. Debenture interest absorbs £9,993, £10,950 is transferred to reserve, and a dividend of 5 per cent., free of tax, is recommended on the ordinary shares, leaving £7,226 to be carried forward.

Stock Exchange Notices.

Dealings in the following have been specially allowed by the Committee under Rule 159 :—

East African Power and Lighting.—270,000 7 per cent. cumulative preference shares of £1 each, issued at £1 1s. per share, partly paid and fully paid, Nos. 1 to 270,000.

Bognor Gas and Electricity Co.—£20,000 new consolidated stock, partly paid and fully paid.

Barcelona Traction, Light and Power Co., Ltd.

The directors have declared a dividend of 1¾ per cent. on the 7 per cent. non-cumulative participating preference shares, payable December 31st. The *Financial News* states that a common stock dividend, together with the corresponding additional dividend on the preference stock, will be declared and paid in January after the closing of the accounts for the current year.

Eastern Telegraph Co., Ltd.

The directors announce the payment on January 15th next of a dividend at the rate of 3½ per cent. per annum on the preference stock for the quarter ending December 31st, and the third quarterly interim dividend of 2½ per cent. on the ordinary stock, free of tax.

Eastern Extension, Australasia and China Telegraph Co., Ltd.

The directors have declared an interim dividend for the three months ended September 30th of 5s. per share, free of tax, payable on January 14th.

Lisbon Electric Tramways, Ltd.

The dividend has been declared on the 6 per cent. cumulative preference shares for the half-year ending December 31st.

Greenwood & Batley, Ltd.

An interim dividend of 2½ per cent. has been declared, as last year.

German Companies.

The *Venta Accumulator and Mining Lamp Company*, Leipzig, reports a small profit for 1926-27, which has again been carried forward.

The *Poege Electricity Company*, Chemnitz, reports that the turnover in 1926-27 was about on the same level as in the previous year, but the sale prices were more unfavourable. The accounts show net profits of 292,000 marks as compared with 217,000 marks in 1925-26, and the dividend is again 6 per cent.

French Company.

The report of the *Société des Etablissements Ducellier*, Paris, for the last financial year, shows a net profit of 1,217,107 fr., as compared with 3,914,795 fr. in 1925-26. No dividend is being declared.

Stocks and Shares.

MONDAY EVENING.

THURSDAY in this week concludes the final Stock Exchange settlement of the year, and dealings are now for payment on January 12th, 1928. This consideration has served to quicken general business in the markets, and although Christmas influences are very present, the tendency of prices is good, on the hopes of cheaper money. It is not too much to say that an announcement from the Government, on the point of a new conversion scheme, is expected any day by some of those people who recall that the latest issue of 4 per cent. Consols was advertised at the end of December, 1926. "Money" stocks are accordingly strong, and capital takes with readiness all the sound securities that come on offer.

Home Rails More Active.

The Home Railway market is attracting a mild degree of attention on dividend prospects. Interest is spasmodic on the part of the public, and the amount of floating supply of stock in the market is meagre. The position lends itself, therefore, to sharp fluctuations in prices. Undergrounds are quietly good, Metropolitans and Underground £1 shares showing moderate improvements.

Electrics.

Points of interest in the home Electric Supply Market this week have been few and far between, with price changes practically nil. Bournemouth and Poole ordinary have been in small demand on rumours of the early termination of the negotiations with the local authorities concerned for the extension of the company's tenure. There has been the usual investment demand for shares and debentures of the London group, whilst of the distributing-cum-holding companies, Electric Supply ordinary have been active, marking as high as 35s. Llanelly have been sold down to 14s. 6d. on anticipations that for the current year the dividend will again be passed. Apart from a hardening tendency in Scottish Power ordinary, there is nothing of interest to report concerning the bulk supply companies' shares. Of the lesser-known companies, Mid-Cheshire Electric ordinary and 7 per cent. preference were dealt in at 15s. 6d. and 19s. 1½d., respectively. In the foreign and Colonial sections there has again been a considerable amount of business in the Atlas Light and Power Company, the new 6 per cent. debenture now being 3 premium. A parcel of the ordinary shares are, at the moment, on the market, and are being absorbed on the basis of 18s. free of stamp. Andhra Valley 7 per cent. debenture was dealt in at 104. The report for the year to June last shows interest covered more than twice. East African Light and Power ordinary are better at 23s. 6d., and we understand that dealings are shortly to commence in the new 7 per cent. preference shares of this company. The opening price will be in the neighbourhood of 21s. 3d. Perak River Hydro Electric ordinary and 7 per cent. debenture are both unchanged. The report for the year 1925 of the Southern Brazil Electric Company made its appearance during the week. Profits have been slightly increased in spite of the drop in milreis during the year in question. As a result, the 6 per cent. bonds were inquired for, and are a point or so better at 75 c.d. The 10s. ordinary shares were also dealt in during the week, the price being 1s.

Tramways.

There is little to write about in the home Tramway Section. The London group is unchanged and uninteresting. Yorkshire (West Riding) Tramways preference at 13s. 9d. have been in demand on the announcement of the payment of the current half-year's dividend. British Electric Traction deferred, at 500 bid, has gained the turn. The Foreign Tramway Section has not been without its active spots during the week. Anglo-Argentine Tramways first and second preference have been in favour, and have risen ¼ and 3/16, respectively. It is understood that the municipality of Buenos Aires is inclined to look with more favour than hitherto on the company's claim for a revision of its system of fares.

Anglo-Argentine Tramways 4 per cent. first debenture at 75½ gives a yield of £5 6s. per cent., and City of Buenos Aires Trams ordinary (which are paying 5 per cent.) at 87s. 6d. yield £5 14s. 3d. As the City of Buenos Aires Company derives its revenue from a rent charge of the Anglo-Argentine Trams Company, ranking in front of that company's 4 per cent. debenture stock, we have the unusual position of an ordinary share ranking, both as to dividend and capital, in front of a debenture stock and, furthermore, giving a higher yield! Brazilian Traction common and preference have fallen a little on sales from Canada. The common, which were at one time down to 218, finished above the lowest at 226, showing a drop of 1¼ points on the week. The preference at 187 have shed 4 points. Barcelona Traction common and Mexican Trams common reacted in sympathy, being 65 and 25, respectively.

Financial Rockets.

British Columbia Electric Railway issues were active, interest being centred on the new deferred shares, in which a large business has again taken place. These shares are

17s. premium, a rise of some 4s. on the opening price of a fortnight ago. This company has given notice of its intention to repay the outstanding 4½ per cent. first mortgage debenture at par, plus accrued interest, on June 20th, 1918. It also desires to redeem the outstanding 4½ per cent. Vancouver Power debenture on the same dates and on the same conditions. The prices have risen many points to the neighbourhood of par. Calgary Power enjoyed the sensational jump of 45 points, to 101, upon declaration by the company of a quarterly dividend of 1¼ per cent.

Cable Stocks.

Anglo-American Telegraph preferred stock has dropped 2½ points to 93¼. Dealers are not eager to buy more in the absence of support. The yield on the money at the present figure is 6½ per cent., which is higher than the stock has offered for years past. Put the other way round, the price is at a low record since 1923. The deferred has moved in contradictory manner, being ¼ up at 24¼, which is equivalent to 97 as compared with the senior, preferred stock quoted at 93¼. "Beam" developments are held responsible for the flatness, but the Eastern group has had a slight recovery. Eastern Telegraph ordinary is unchanged at 150: Eastern Extensions rallied 5s. to 15: both companies have declared their usual quarterly dividend at the rate of 10 per cent., tax free, payable next month. Westerns remain weak at 14, and Globe ordinary stand level with the two Eastern issues. Telegraph Constructions are £1 down at 24½.

The Eastern Quartette.

A letter issued in defence of the Eastern quartette, by a well-known firm of Stock Exchange dealers, goes closely into the matter of reserves and balance-sheets. The firm points out that the Eastern Company, taking reserves into account, showed in its last balance-sheet net assets equal to £174 per £100 Eastern stock. The Eastern Extension and the Western Companies, on the same basis of calculation, have assets equivalent to £21 per £10 share apiece. The Eastern reserves and carry forward, at the end of last year, were 3¾ million pounds, equal to 75 per cent. of the ordinary capital. The Eastern Extension and Western companies show reserves and carry forward larger than their ordinary share capitals. The figures bear repetition because of the genuine anxiety aroused in the minds of proprietors who hold the stocks and shares as permanent investments. Undoubtedly the competition of wireless, to-day, is a more serious matter to the cable companies than it has ever been in the past, and the investors in the latter concerns would feel no little relief if a co-operative system of cable and wireless working were to be put into force.

Automatic Telephony.

Automatic Telephones have failed to regain the loss of 1s. 9d. sustained last week. Internationals are also dull. A private party of City men were invited to pay a visit to the Holborn exchange on the Tuesday in this week, in order that the working of the new system could be shown by lecture and practical illustration.

Marconis.

Marconis have been a good market. The 5 per cent. dividend aroused a shade of disappointment: many people had been looking for 7½ per cent., and some expected 10 per cent. The profit figures are considered excellent, and, on the strength of these, Marconi ordinary rose to 34s. 6d. The present price of 33s. 9d. represents half a crown gain on the week. Canadian Marconis have been moving in animated fashion. We showed last week that the price had dropped from 11s. 3d. to 8s. 9d. on the chairman's statement that "there is no prospect in sight warranting the trading in the shares." Nobody understood the precise meaning of this cryptic statement, but clearly it was not a bull point, and so the price came down. Now it is up again to 10s., with Canada still lending support.

Manufacturing Companies' Shares.

Johnson & Phillips, after their sudden jump to 53s., came back to nearer 50s. The latest rumour is that the company may increase its next dividend. Callenders reacted to 78s. 9d. and British Insulated to 4 1/16. What people say is that the current prices of the shares in the best-class manufacturing companies' discount, already, advanced dividends in the near future. The reply is that while such argument is perfectly logical, the companies are likely to fall in with the amalgamating tendency of the age, and to form one powerful combination. This is considered sufficient justification for the prices to stand upon what are obviously high levels, even when due weight is given to the prospect of improved dividend distribution. Babcock & Wilcox are better at 3 1/16. The company is said to be closely interested in one of the new coal-distillation processes by which it is claimed that costs will be materially reduced. Iron and steel shares are none too firm. In spite of the brightening outlook that appears to open for national trade and industry, the "Heavy" branches hasten but slowly. Rubber shares are inclined to strengthen in consequence of a rise in the price of raw product.

It is pleasant to be able to express the hope, with a reasonable assurance of its being true, that most investors will find in our Stock Exchange prices a comfortable contribution to their Merry Christmas.

Share List of Electrical Companies.

	Nom. £	Dividend. 1925.	Dividend. 1926.	Price Dec. 19 1927.	Rise or fall.	Yield. p.c.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	14	14	59/3	—	4 14 5
Brompton Ordinary	1	10	8¾	24/6	—	5 14 3
Charing Cross Ordinary	1	15	8½	25/6	—	5 9 10
do. do. 4½ Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	8¾	25/6	—	5 9 10
City of London	1	15	7½	30/-	—	4 0 0
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	32/-	—	5 0 0
County of London	1	15	7½	28/6	—	4 18 3
do. do. 6% Pref.	1	6	6	28/-	—	5 4 4
Edmundson's Ordinary	1	8	10	45/-	—	4 8 11
do. 7% Pref.	1	6	7	24/6	—	5 14 3
Elec. Supply Corporation	1	10	10	23 9	—	5 18 6
Kensington Ordinary	1	15	8	25/6	—	5 9 10
Lancs. Light and Power	1	7½	7½	27/-	—	5 11 1
London Electric	1	10	8½	24/6	—	5 14 3
do. do. 6% Pref.	5	6	6	5¾	—	5 11 3
Metropolitan	1	11	8	30/-	—	4 13 4
do. 4½% Pref.	1	4½	4½	17/-	—	5 8 6
Midland Counties	1	5½	6	24/-	—	5 0 10
Newcastle-on-Tyne Ordinary	1	7	5	23/9	—	4 4 3
do. 5% Pref.	1	5	5	17/6	—	5 14 3
do. 7% Pref.	1	7	7	25/-	—	5 12 0
Notting Hill 6% Pref.	10	6	6	10⅞	+⅛	5 10 4
North Met. Elec. 6% Pref.	1	6	6	22.6	—	5 6 8
St. James' and Pall Mall	5	17½	8	26/-	—	5 7 8
South London	1	15	8½	25/6	+6d.	5 9 10
South Metropolitan Pref.	1	7	7	1¼	—	6 8 0
Urban Ordinary	1	7	7	1⅝	+1/16	8 14 8
do. 6% Pref.	1	6	6	1 1/16	—	5 18 0
Westminster Ordinary	1	15	8½	25/6	—	5 9 10
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	21/8	—	7 1 2
Yorkshire Elec.	1	8	8	32/-	—	5 0 0
HOME RAILS.						
Central London Ord. Assented	Stock	4	4	71	—	5 12 6
Metropolitan	,,	5	5	64½	+½	4 13 0
do. District	,,	3½	3½	63½	—	5 10 3
Underground Electric	£1	Nil	1½	19.6	+6d.	1 10 7
do. do. Income	Bonds	6	6	105	—	5 14 3
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	Stock	6	6	93½	−2½	6 8 4
do. Def.	,,	1½	1½	2 3/4	+½	6 8 9
Automatic Telephone	1	3	10	46/3	—	4 6 6
Chili Telephone	5	5	5	7⅞	—	3 18 3
Eastern Extension	10	10	10	15	+¼	*6 13 4
Eastern Tel. Ord.	Stock	10	10	170	—	*6 13 4
Globe Tel. and T. Ord.	10	10	10	15	—	*6 13 4
do. do. Pref.	10	6	6	10¾	+¼	5 11 7
Great Northern Tel.	10	20	20	38½	+1¼	5 4 0
Indo-European	25	8½	10	40	—	*6 5 0
Marconi	1	Nil	Nil	33/9	+2/6	.. ..
Marconi-Marine	1	7½	8¾	30/-	—	5 16 8
Oriental Telephone Ord.	1	12	12	50/-	—1/3	*4 16 0
United R. Plate Tel.	5	8	8	9¾	—	*4 2 1
Western Telegraph	10	10	10	14	—	*7 2 10
HOME AND FOREIGN TRAMS, &c.						
Anglo-Arg. Trams First Pref.	5	5½	5½	8¾	+¼	7 6 8
do. do. 2nd Pref.	5	6	6	8¾	+3/16	8 0 0
do. do. 5% Deb.	Stock	5	5	74½	—	6 14 3
British Electric Traction Def. Ord.	,,	8	8	500	—	... ...
do. do. 8% Pref. Ord.	,,	6	8	123½	—	6 9 7
Brazil Traction	100	5	6	226	−1½	2 13 1
Brit. Columbia Elec. Ry. Pcc.	Stock	5	5	99½	—	5 6 11
do. do. Preferred		6¾	6¾	143½	—	4 7 1
do. do. Deferred	,,		8	183	—	*4 7 5
do. do. Deb.	,,	4¾	4¾	99	+18½	4 5 6
London & Sub. Trac. 5% Pref.	1	Nil	Nil	8/-	—	... ...
London United Tram. Deb.	Stock	4	4	56½	—	7 1 7
Mexico Trams, 5% Bonds	—	5	5	72	—	6 18 11
Mexican Light Common	100	Nil	Nil	59	+3	Nil
do. Pref.	100	Nil	Nil	74	−2	Nil
do. 1st Bonds	—	5	5	77½	−1	6 9 0
Yorkshire (West Riding)	1	5	—	7/6	—	... ...
MANUFACTURING COMPANIES.						
Babcock & Wilcox		12	12	3 1/16	+1/16	4 4 10
British Aluminium Ord.	1	12½	10	45/6	—	4 8 0
British Elec. Transformer Prel.	1	Nil	7	18/9	—	7 18 6
British Insulated Ord.	1	15	15	4 1/16	−1/16	3 14 0
Brush Ord.	1	10	10	28/9	—	6 16 4
Callenders	1	15	15	3 15/16	−1/16	8 16 4
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 8
Crompton Parkinson Pref. Ord.	1	Nil	Nil	16/-	—	... ...
Edison-Swan	4/-	10	10	10/-	—	4 0 0
do. 5% Deb.	Stock	5	5	90	—	5 11 1
Electric Construction	1	10	7½	28/9	—	5 4 4
Enfield Cable Pref.	1	7½	7½	25/-	—	6 0 0
English Electric	1	Nil	Nil	8/9	—	... ...
do. Pref.	1	8	—	11/3	—	... ...
Gen. Elec. Pref.	1	6½	6½	24/-	—	5 8 4
do. Ord.	1	7½	7½	34/-	—	4 6 1
Henley	1	20	25	102/6	—	4 17 8
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	5	—	18 9	−1/3	... ...
Johnson & Phillips	1	17½	12½	49/3	—	5 1 8
Met.-Vickers Ord.	1	8	8	30/-	—	5 6 8
do. Pref.	2	8	8	2⅞	—	6 4 8
Siemens Ord.	1	7	7½	30/-	—	5 0 0
Telegraph Construction	12	10	10	24½	−1	*5 0 0

* Dividends paid free of Income Tax.

Our Foreign Electrical Trade.

Electrical Exports and Imports during November, 1927.

THE figures which we reproduce below recording Great Britain's electrical exports and imports for the month of November make a far better showing than those of the preceding month. In the first place, the exports reached the highest level of any month of the year; the previous highest was January, £1,710,258. Then the figure was only exceeded once during 1926, in September, when the total was inflated by an abnormal exportation of submarine cable. As compared with October last, there was the substantial increase of £292,981. The principal classes contributing to this result were unenumerated electrical machinery (£65,414), submarine telegraph and telephone cable (£57,662), telegraph and telephone apparatus (£56,655), and unenumerated electrical goods and apparatus (£46,602). Insulated wires and cables also recorded a satisfactory increase. Both of the unenumerated classes reached the highest point of the year. The decreases were not of very large dimensions. The comparison with November, 1926, is not quite so satisfactory, but still good. The outstanding rise is again in unenumerated electrical machinery, while submarine cables, non-submarine telegraph and telephone wires and cables, and unenumerated goods and apparatus also made important gains. There was a large fall in insulated wires and cables, and others occurred in telegraph and telephone apparatus, railway and tramway motors, and "other" motors and generators.

Although the imports fell by £4,717 from the preceding month's figure, they were still substantially higher than in any month of 1926. The increases predominated in number, but their total was outweighed by the large declines in the imports of insulated wires and cables, batteries and accumulators, and unenumerated electrical machinery. The only outstanding increase was one of £26,265 in unenumerated electrical goods. As a matter of interest, attention may be drawn to the importation of £56 worth of submarine cable—a rare event. In comparison with the corresponding month of last year, there was a substantial rise in imports—£77,102. This was mainly due to increases in unenumerated electrical machinery and goods and apparatus. The only large decline occurred in the case of batteries and accumulators.

The re-export total showed a gain in both comparisons principally on account of the larger shipments of unenumerated machinery.

The eleven-months' totals show that while exports rose by about £650,000, there was an increase of over £860,000 in imports. This assumes a more impressive aspect when the relative proportions are remembered; exports are generally between three and four times the value of imports, although in October and November imports rose to more than a third of exports.

We give below, as usual, a market analysis of electrical machinery exports during November:—

Destination.	Nov., 1926. £	Nov., 1927. £	Inc. or dec. £
Europe	89,616	78,401	−11,215
Japan	8,068	42,751	+34,683
South America	21,034	73,512	+52,478
South Africa ...	99,365	73,846	−25,519
British India ...	135,025	95,421	−39,604
Australia ...	80,089	99,947	+19,858
New Zealand ...	21,197	38,543	+17,346
Canada	41,568	29,441	−12,127
Other countries	98,575	86,515	−12,060
Total ...	£594,537	£618,377	+£23,840

	Exports. Electrical exports for Nov., 1927.	Inc. or dec. as compared with Oct., 1927.	Inc. or dec. as compared with Nov., 1926.	Imports. Electrical imports for Nov., 1927.	Inc. or dec. as compared with Oct., 1927.	Inc. or dec. as compared with Nov., 1926.	Re-Exports. Electrical re-exports for Nov., 1927.	Inc. or dec. as compared with Oct., 1927.	Inc. or dec. as compared with Nov., 1926.
Electrical goods and apparatus (unenumerated)	£222,721	+£46,602	+£30,531	£151,710	+£26,265	+£26,401	£6,129	+£287	−£443
Insulated wires and cables ...	274,278	+29,874	−62,868	58,983	−20,595	+1,250	934	−212	+385
Glow lamps	12,988	+8,811	−7,834	53,883	+5,705	+7,848	880	+596	−919
Arc lamps and parts ...	603	−5,101	−61	3,004	−851	+1,846	151	+129	+148
Batteries and accumulators ...	88,140	−7,680	−6,332	90,656	−16,896	−11,347	498	+118	+76
Meters and instruments ...	41,295	+15,183	+4,535	28,212	+3,000	+8,320	454	−3,150	+95
Carbons	3,573	+515	+1,867	8,931	+1,927	−760	16	−8	—
Electrical Machinery—									
Electrical machinery (unenumerated)	365,381	+65,414	+77,547	127,645	−15,502	+39,637	14,162	+3,821	+7,019
Railway and tramway motors	37,951	−6,612	−31,835	—	—	—	—	—	—
Other motors and generators...	215,044	+19,414	−21,872	—	—	—	—	—	—
Switchboards (not telegraph or telephone)	8,027	+2,760	+384	22	−67	−301	—	—	—
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	107,230	+9,984	+45,480	17,792	+5,954	+6,999	—	−109	−40
Submarine telegraph and telephone cable... ...	71,687	+57,662	+54,637	56	+56	+56	—	—	—
Telegraph and telephone instruments and apparatus ...	281,659	+56,655	−38,422	62,766	+6,287	−2,837	4,872	−375	+1,216
Totals	£1,770,978	+£292,981	+£45,757	£602,980	−£4,717	+£77,102	£28,096	+£1,097	+£7,537
Increases for eleven months of 1927		EXPORTS: +£648,595			IMPORTS: +£866,237			RE-EXPORTS: +£1,195	

East African Electrical Imports.

In a recent report on the trade and commerce of East Africa by Mr. C. Kemp, Deputy Trade Commissioner at Nairobi (Stationery Office, 2s. net), figures of imports are quoted. It is seen that during 1926 electrical goods and apparatus valued at £24,516 were imported into Kenya and Uganda, against £9,691 in 1925. The bulk of these (£19,445) came from Great Britain. The Tanganyika Territory imported electrical goods to the value of £20,848 (against £5,294), of which £18,938 worth was supplied by Great Britain. Zanzibar's electrical imports during 1926 amounted to £3,069 (against £1,337), Great Britain accounting for £1,014 and Germany for £1,387. The imports of electrical machinery into Northern Rhodesia during 1926 are given as £25,024, as compared with £20,803 in 1925. The United Kingdom's share fell from £18,434 to £17,782, while that of the United States rose from £2,173 to £5,778.

The report states that the temporary suspension of capital projects prevents any expected large increase in the importation of electrical goods and apparatus. When these projects are undertaken it can confidently be expected that Great Britain will secure the bulk of the orders placed. With regard to small electrical articles, cheap offers of good quality lamps of Dutch manufacture have somewhat displaced British importations.

The Electrical Trade of Austria.

Figures for 1925 and 1926 Compared.

THE following tables give particulars of Austria's imports and exports of electrical machinery and apparatus in 1926, the total values in schilling (34½ schilling = £1), together with the total weights in quintals and the weights by countries of origin or destination, except in the case of lamps where the figures are in thousands instead of weights. Comparative figures for 1925 are given where available for purposes of comparison and notes are added of increases or decreases :—

Imports.

	1925.	1926.	Inc. or dec.
Dynamos and motors—			
Value in 1,000 schilling ...	3,612	4,299	+ 687
Number	13,060	17,605	+4,545
Weight in quintals	3,874	4,611	+ 737
From Germany	2,214	2,938	+ 724
,, Italy	27	33	+ 6
,, Switzerland	467	571	+ 104
,, Czecho-Slovakia ...	106	204	+ 98
,, Hungary	997	714	− 283
Parts of ditto—			
Value in 1,000 schilling ...	477	948	+ 471
Weight in quintals	825	2,122	+1,297
Dynamos and motors connected with mechanical plant—			
Value in 1,000 schilling ...	801	2,003	+1,202
Number	5,044	12,367	+7,323
Weight in quintals	535	1,262	+ 727
From Germany	479	970	+ 491
,, Czecho-Slovakia ...	2	34	+ 32
,, Switzerland	24	37	+ 13
Stationary transformers—			
Value in 1,000 schilling ...	1,288	1,661	+ 373
Number	2,534	3,109	+ 575
Weight in quintals	1,498	2,491	+ 993
From Germany	912	1,043	+ 131
,, Switzerland	505	1,339	+ 834
,, Hungary	65	73	+ 8
Rotary transformers—			
Value in 1,000 schilling ...	491	161	− 330
Number	130	175	+ 45
Weight in quintals	910	223	− 687
From Switzerland	688	19	− 669
,, Hungary	164	176	+ 12
Telegraph apparatus—			
Value in 1,000 schilling ...	35	63	+ 28
Weight in quintals	8	13	+ 5
*Telephone apparatus—**			
Value in 1,000 schilling ...	2,683	2,636	− 47
Weight in quintals	416	498	+ 82
Radio apparatus—			
Value in 1,000 schilling ...	1,315	1,333	+ 18
Weight in quintals	248	196	− 52
From Germany	169	92	− 77
,, Great Britain	40	30	− 10
*Röntgen and electro-medical apparatus—**			
Value in 1,000 schilling ...	517	806	+ 289
Weight in quintals	252	333	+ 81
Electricity meters and measuring apparatus—			
Value in 1,000 schilling ...	2,512	2,295	+ 217
Weight in quintals	1,312	911	− 401
From Germany	1,135	763	− 372
,, Switzerland	155	111	− 44
,, Czecho-Slovakia ...	3	2	− 1
,, Hungary	13	26	+ 13
Incandescent lamps—			
Value in 1,000 schilling ...	3,330	3,225	− 5
Thousands	3,000	3,038	+ 38
From Germany	2,121	2,059	− 62
,, Hungary	743	948	+ 205
Heating and cooking apparatus and electric irons—			
Value in 1,000 schilling ...	340	216	− 124
Weight in quintals	229	142	− 87
From Germany	173	124	− 49
Other electrical apparatus—			
Value in 1,000 schilling ...	5,740	9,054	+3,314
Weight in quintals	5,000	6,296	+1,296
From Germany	3,631	5,406	+1,775
,, Italy	8	11	+ 3
,, Switzerland	339	274	− 65
,, Czecho-Slovakia ...	432	156	− 276
,, Hungary	408	310	− 98
*Insulating tubes—**			
Value in 1,000 schilling ...	122	198	+ 76
Weight in quintals	625	1,116	+ 491
Lead-covered cable—			
Value in 1,000 schilling ...	17	12	− 5
Weight in quintals	49	49	—
From Great Britain	36	—	− 36
,, Germany	12	33	+ 21
Other cables and insulated wire—			
Value in 1,000 schilling ...	583	280	− 303
Weight in quintals	356	265	− 91
From Germany	245	109	− 136
,, Italy	39	30	− 9
,, Switzerland	51	46	− 5
Accumulators and plates—			
Value in 1,000 schilling ...	120	163	+ 43
Weight in quintals	301	270	− 31
From Germany	228	163	− 65
,, Sweden	45	79	+ 34

* Mainly from Germany.

Exports.

	1925.	1926.	Inc. or dec.
Dynamos and motors—			
Value in 1,000 schilling ...	7,687	7,139	− 548
Number	10,299	12,656	+2,357
Weight in quintals	19,151	17,162	−1,989
To Belgium	69	—	− 69
,, Bulgaria	728	1,025	+ 297
,, Germany	2,468	2,212	− 256
,, Italy	2,029	736	−1,293
,, Poland	3,278	1,045	−2,233
,, Rumania	2,430	2,198	− 232
,, Jugo-Slavia	2,250	2,565	+ 315
,, Czecho-Slovakia ...	3,952	3,691	− 261
,, Hungary	818	714	− 104
Parts of ditto—			
Value in 1,000 schilling ...	1,178	916	− 262
Weight in quintals	2,666	1,664	−1,002
Dynamos and motors joined to mechanical plant—			
Value in 1,000 schilling ...	510	497	− 13
Weight in quintals	490	370	− 120
Number	4,430	3,625	− 805
To Great Britain	179	124	− 55
,, Jugo-Slavia	38	11	− 27
,, Czecho-Slovakia ...	23	116	+ 93
,, Russia	—	78	+ 78
,, Poland	124	4	− 120
Stationary transformers—			
Value in 1,000 schilling ...	1,682	1,482	− 200
Number	15,522	13,705	−2,417
Weight in quintals	4,619	3,524	−1,095
To Germany	28	205	+ 177
,, Italy	498	111	− 387
,, Poland	669	151	− 518
,, Rumania	425	742	+ 317
,, Jugo-Slavia	670	1,399	+ 729
,, Czecho-Slovakia ...	1,867	472	−1,395
Telegraph apparatus—			
Value in 1,000 schilling ...	160	78	− 82
Weight in quintals	56	55	− 1
To Poland	18	5	− 13
,, Rumania	9	11	+ 2
,, Jugo-Slavia	9	5	− 4
Telephone apparatus—			
Value in 1,000 schilling ...	6,940	5,315	−1,625
Weight in quintals	1,838	1,569	− 269
To Germany	477	257	− 220
,, Great Britain	194	9	− 185
,, Italy	192	97	− 95
,, Czecho-Slovakia ...	468	553	+ 85
,, Netherlands	—	187	+ 187
,, China	—	112	+ 112
Radio apparatus—			
Value in 1,000 schilling ...	2,858	5,321	+2,463
Weight in quintals	607	1,075	+ 468
To Belgium	61	43	− 18
,, Germany	72	223	+ 151
,, Great Britain	116	112	− 4
,, Italy	80	45	− 35
,, Czecho-Slovakia ...	41	183	+ 142

	1925.	1926.	Inc. or dec.
Electricity meters and measuring apparatus—			
Value in 1,000 schilling ...	1,882	1,944	+ 62
Weight in quintals	1,875	1,291	− 584
To Germany	115	28	− 87
,, Italy	20	7	− 13
,, Portugal	277	131	− 146
,, Jugo-Slavia	43	117	+ 74
,, Czecho-Slovakia	91	36	− 55
,, Hungary	71	66	− 5
Incandescent lamps—			
Value in 1,000 schilling ...	17,954	19,901	+1,947
Thousands	17,951	20,390	+2,439
To German Ports	6,257	4,930	−1,327
,, Germany	3,653	2,303	−1,350
,, Great Britain	2,050	1,898	− 152
,, Italy	1,020	2,079	+1,059
,, Czecho-Slovakia	519	557	+ 38
,, India	382	260	− 122
,, Egypt	346	246	− 100
,, United States	269	2,955	+2,686
,, Mexico	410	73	− 337
Heating and cooking apparatus and electric irons—			
Value in 1,000 schilling ...	487	322	− 165
Weight in quintals	624	414	− 210
To Germany	71	15	− 56
,, Italy	60	75	+ 15
,, Jugo-Slavia	176	83	− 93
,, Hungary	52	35	− 17
,, Rumania	92	53	− 39
Other electrical apparatus—			
Value in 1,000 schilling ...	6,591	5,822	− 769
Weight in quintals	8,583	8,827	+ 244
To Germany	502	506	+ 4
,, Italy	251	312	+ 61
,, Poland	1,321	810	− 511
,, Rumania	660	1,101	+ 441
,, Switzerland	44	42	− 2
,, Jugo-Slavia	1,761	1,941	+ 180
,, Czecho-Slovakia	2,098	1,631	− 467
,, Hungary	532	741	+ 209
Insulating tubes—			
Value in 1,000 schilling ...	434	341	− 93
Weight in quintals	2,731	2,273	− 458
Röntgen tubes and electro-medical apparatus—			
Value in 1,000 schilling ...	853	1,485	+ 632
Weight in quintals	489	663	+ 174
To Germany	104	132	+ 28
,, Rumania	63	121	+ 58
,, Jugo-Slavia	126	117	− 9
,, Czecho-Slovakia	78	108	+ 30
Lead-covered cable—			
Value in 1,000 schilling ...	1,736	2,020	+ 284
Weight in quintals	8,637	9,868	+1,231
To Belgium	348	—	− 348
,, Bulgaria	386	278	− 108
,, Poland	3,303	664	−2,639
,, Rumania	781	1,759	+ 978
,, Jugo-Slavia	3,237	5,391	+2,154
Other cables and insulated wires—			
Value in 1,000 schilling ...	4,632	2,990	−1,642
Weight in quintals	10,046	6,347	−3,699
To Belgium	474	—	− 474
,, Great Britain	590	420	− 170
,, Poland	2,805	711	−2,094
,, Rumania	1,741	756	− 985
,, Jugo-Slavia	1,445	950	− 495
,, Czecho-Slovakia	508	396	− 112
Accumulators and plates—			
Value in 1,000 schilling ...	492	556	+ 64
Weight in quintals	1,269	1,648	+ 379
To Jugo-Slavia	792	1,418	+ 626

The German Radio Industry.

The *Deutsche Bergwerks Zeitung* says that producers of radio material in Germany are at present very busy. Orders from the trade, which were not very large in the autumn months, are now increasing. Difficulties are already beginning to arise at some factories in completing orders in the specified time, especially as supplies of raw material are sometimes not so quickly obtainable. It is generally estimated that Christmas business this year will exceed that of last year. Cheap simple sets and expensive luxury sets are especially required; medium quality sets are not much in demand.—*Reuter's Trade Service* (Dusseldorf).

Reviews.

Easy Lessons in Wireless. By ROBERT W. HUTCHINSON, M.Sc., A.M.I.E.E. Pages viii+168; figs. 141. London: University Tutorial Press, Ltd. Price 1s. 6d. net.

There are many, far too many, amateur experimenters who are trying to make their wireless bricks without straw. In this book Mr. Hutchinson supplies the straw. But there is nothing new in that: it has been supplied by an unending stream of books during these last few years, but none the less, in fact all the more, do we welcome Mr. Hutchinson's straw, for his work on electrical and wireless text-books is well known and appreciated. This little book must have been one of his most difficult tasks—to explain the fundamental principles of wireless reception to people who have had no electrical training whatever; and he has done it extremely well.

Such books, if they are to be good, require an author of teaching experience, and in that Mr. Hutchinson is fortunate, and makes good use of his work in the classroom. He writes colloquially (even to an occasional split infinitive), stresses the important points, omits the unessentials, and is ever ready to go on repeating what should be repeated. We like his advice about loud-speakers—"take one belonging to a friend (not your own) to pieces and have a look at it"—and we hope that the "not your own" refers to the friend as well as the loud-speaker.

We think that he might have made less of the difficulty of conventional and electronic currents, that he might have omitted the coherer and all its works, that he need not have differentiated between oscillations per second and frequency, that he should not have mentioned 100 metres as the lower limit of wireless waves, that 1,400 kW is too high a figure to give for the power of Rugby, and that 100 metres is much too long for the waves used by the beam stations.

The book includes chapters on the theory of electricity, simple wireless receiving apparatus, the principal crystal and valve circuits, hints on aerials and earths, transmitting for amateurs, and it is furnished with an index.

It is an excellent 1s. 6d. worth, and anyone who reads it cannot fail to grasp the principles of broadcast reception and how these principles can best be applied.

Simplified Practice. By C. CHISHOLM. Pp. xii+151; illustrated. London: Chapman & Hall, Ltd. Price 12s. 6d. net.

"We are, in a broad sense, confronted with a great many economic difficulties—the necessity to maintain high wage level, the consequent necessity to reduce all processes of manufacture to the lowest possible costs, and under the compulsion of eliminating every possible waste of industry itself." These were Mr. Hoover's remarks to the first conference of manufacturers held in Washington in November, 1921. These principles apply equally to our industries, and therefore we should all study the result of America's experiences in applying them during the last six years; this is what Mr. Chisholm has endeavoured to do in his "Simplified Practice." He points out that "Simplification is the answer of the Industrialists of U.S.A. to high labour costs and depreciated exchanges." If cheap labour is to be Germany's "long suit," superior management of complete industries as well as of individual concerns, her industrialist felt, must be America's trump card.

No matter how much some people try to persuade themselves to the contrary, they will eventually realise that the high wages now established in sheltered occupations have come to stay, because, for local and national political reasons, no party dare attempt to reduce them; thus, a new standard has been firmly established, and the most pressing need for industry (if it is to survive against wide-world competition) is to carefully study facts given in Mr. Chisholm's work and apply them in our various trades, and then the established high-wage standard will not shut us out of world markets. Frankly, Mr. Chisholm has not marshalled his facts in the best way to appeal particularly to our older industrialists, and, unfortunately for this country, it has been the man over 60 who really controls many industries. He gained his experience under entirely different industrial conditions, namely, when we led in manufacturing, and his mind is now quite fixed. Years roll on, and these men eventually die, and the younger man brought up in an atmosphere of present-day experience has to carry on, but the "foundations of organisation" may have been cracked, and he has to repair these by reorganisation, before he can hope to progress.

It is the writer's opinion (based on discussions with these older men) that many authors of works like Mr. Chisholm's do not study sufficiently the psychology of the older man in industry before writing their work, and then marshal their facts so as to appeal to these men really controlling affairs. The reviewer recommends that all men over 50 should carefully read this work, so as to be sure they know some important facts of the advance in organisation of industries in America, and not turn it aside because it gives voluminous details of simplification of the "brick trade" and the "bedstead" industry of that country, for from these facts can be extracted valuable data for any industry. Our

own industry is referred to in several places. A suggestion in the opening chapter is important, *viz.*, "things can never be improved until managing directors have laid down definite ruling against the needless multiplication of models, patterns, and sizes." This is a principle that is fundamental, and, as Mr. Chisholm says later on in his book, one that should be extended throughout our own industry. Take the number of people who are making electric motors—each has its own, say, 15-h.p. motor, each has designing staff to design the machine, its own jigs to manufacture, its own supervising staff in works, each has its own selling staff, probably each has a different costing system, all in each works producing an electric motor of similar performance—what economies would accrue if all motors were made, costed, and sold on the basis of each works specialising on a different range of performance! Mr. Chisholm says in his book: "that which can be done by individual business for its own good can frequently be done by an entire industry to its great benefit," and it should be particularly noticed that "Simplified Practice is not aimed solely at production of cheap goods merely for cheapness' sake. Its aim is rather to produce high quality articles made on precision lines at lowest possible price."

The book warns manufacturers of the original failure of Taylor's methods in the United States—of the danger of laying too much stress on increasing profits, this incensing labour unions. Taylor's methods of increasing service both to workers in the industry as well as customers, would have been much more successful, for, as the author wisely observes: "If the nineteenth century was dominated by the captains of industry, the twentieth promises to be dominated by the administrators of industry—to apply methods of science to processes of industry, to direct workers in the light of the most modern discoveries in industrial psychology and in personal management." The author shows how the difficulties of co-ordinating manufacturers, factors, distributors, were dealt with by the Division of Simplified Practice of U.S.A. Government; we have not established such a department, although in some industries attempts are being made to apply the principles by the good offices of trade associations, but this, as Mr. Chisholm suggests, wants extending to fully embrace the following:—

(*a*) To facilitate mass production through concentration on fewer varieties, and thus decrease cost of manufacture.

(*b*) To focus demand on specific varieties enabling manufacturers to produce for stock in otherwise dull seasons, and thus permit more regular rise of both labour and plant, and

(*c*) To stimulate turnover of stock, and through assured demand as well as delivery when wanted, operate on smaller stock investment.

The author gives a chapter on the work of the British Engineering Standards Association which, to those not familiar with the accomplishments of this body, should be valuable information, and he further makes suggestions for the extension of this work by the establishment of a Government Department of Simplified Practice to encourage standardising bodies to run a promotion department. It would have been interesting if Mr. Chisholm had indicated on what lines he thinks this could be applied in this country.

Although some of the statistics given in the book are a little monotonous and are repeated too often (and therefore may make a reader inclined to put the work down without finishing it) the reviewer is satisfied that there is much very valuable information therein, and trusts that it may lead some influential member of our Government to make some move on the lines adopted in the United States, for "simplification" of our manufacture and distribution—for our Empire, in his opinion, if administered as a Union of States, has much greater industrial possibilities than the United States.

Kempe's Engineers' Year Book, 1927. 34th Edition. Edited by H. R. KEMPE and W. HANNEFORD SMITH. Pp. 3,101+79; illustrated. London: Crosby, Lockwood & Son. Price 30s. net.

In accordance with the practice in past years, the new edition of this popular and valuable work has been revised throughout and, it is claimed, brought up-to-date. It is difficult to define nowadays what are the elements of general engineering which come, directly or indirectly, within the field of the electrical engineer, and this fact is emphasised after looking through the pages by the fairly safe conclusion that more concerns the general electrical engineer outside the electrical engineering section than within it. The work of compiling the mass of engineering information contained in the three thousand odd pages is a vast one, and perhaps it would not be fair to ask or expect some sort of co-ordination between all the sections, sub-sections, &c., which concern the electrical engineer; nevertheless, such an arrangement would be helpful. The electrical engineering section shows some signs of revision, but it is a little disappointing to see in a year book the same electrical machines illustrated and specified as in the previous edition. The usual abbreviated I.E.E. rules are given, and cover the recent revision. The section on steam and steam machinery is a highly creditable work, and is practically a detailed treatise on the subject. As already indicated, there are many electrical sub-sections or paragraphs "hidden" in the volume and it might be interesting to draw attention to some of them. Modern electric signalling is dealt with in the section on railways; the section dealing with cranes &c., includes useful information concerning modern electric-lift and winding practice; and hydro-electric work is treated under hydraulics.

As usual, the progress made in the electricity supply industry during the year prior to publication is outlined in the opening chapter—"The Past Year's Progress."

New Wiring Systems.

Non-metal-sheathed wiring systems have been introduced by the Macintosh Cable Co., Ltd., Messrs. W. T. Henley's Telegraph Works Co., Ltd., and Messrs. Johnson & Phillips, Ltd.

THE following systems of wiring have been produced primarily to meet the conditions usually found in connection with the lighting of works in which the atmospheric conditions obtaining are destructive to ordinary electric fittings. They should also prove useful in connection with the lighting of open-air markets and outdoor lighting generally.

The Macintosh Industrial Wiring System.

The cable employed in this is the No. 3 type "Maconite," insulated and sheathed, for which special fittings have been designed to provide immunity from corrosion or chemical action, and gas and water tightness.

The following units of moulded composition are employed: junction box, ceiling rose, switch, well fitting, and distribution fuse board. The cable is sealed into the various fittings by means of a moulded "Maconite" gland of square section, which, by means of a special tool, can be perforated to take the required number and size of cables into the various fittings. Suitable punches are provided for the various sizes of cables.

Fig. 1 clearly shows the construction of the junction box, the component parts of which are the base, "Maconite" gland, cover, holding-down studs, and terminal ring. The base is fixed in the position decided upon and the gland punched for the cables which are threaded through the holes, leaving sufficient length for easy manipulation of the gland on the base. The excess is then cut off the cables, the insulation trimmed back, the terminal ring placed in position and the conductors secured in the terminals. The cover is fastened down by means of milled studs.

The switch unit, fig. 2, embodies a 5-A "Diamond H" s.p. switch, and the method of wiring it up is similar to that of the junction box, with the exception that the

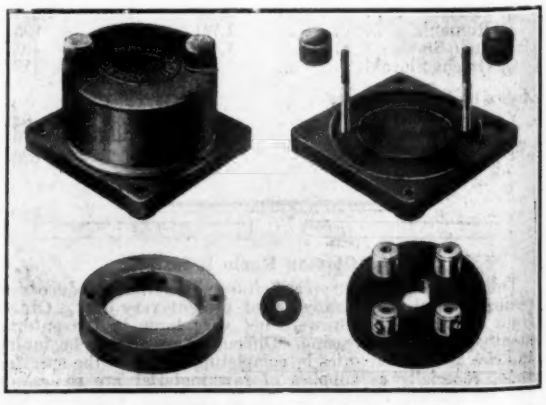


Fig. 1. Construction of Macintosh Junction Box.

conductors are led into the switch terminals instead of the terminal ring. Similarly, in the case of the ceiling rose, fig. 3,

the sealing gland is used in conjunction with a suitable terminal base.

"Maconite" insulated and sheathed flex is used for the pendant drop, suitable bushing being provided.

The well fitting consists of a standard cast-iron base and ring for a 3-in. well glass, suitable washers being supplied for sealing the flange of the glass to the c.i. ring. The base is fixed in position, and subsequently the gland and c.i. ring, after wiring up as in the case of the junction box.

Fig. 2.—Macintosh Switch Unit.

The distribution board, which is standardised as 6-way (d.p.), is designed on the unit principle, and, when required, can be made into 12 or 18 ways by additional boards connected to the terminals provided. The gland in this case is rectangular. The fuses employed are of the "Artic" 10-A type.

The Henley Nomet Wiring System.

This system employs a single cable of circular section and twin and 3-core cables of flat sections, but wherever possible

Fig. 3.—Macintosh Ceiling Rose.

the latter types are recommended as making a neater job. The cables are of the c.t.s. type and each core has a distinctive colour. For ordinary positions the cable fixing is effected by link and strap clips.

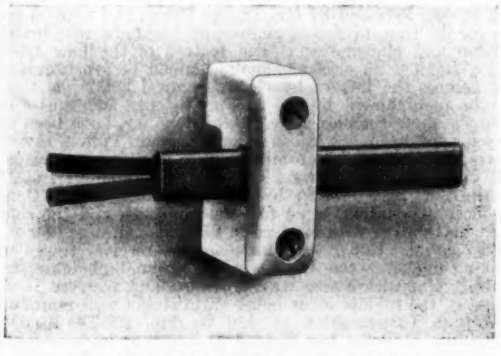


Fig. 4.—Porcelain-Cleat Fixing; Henley System.

Fixing by means of porcelain cleats is also adopted, as shown in fig. 4, suitable cleats being supplied for all types of cable. For those cases where it is required to support the wire along its length, wood casing is provided. This also offers some mechanical protection, but for this purpose the makers' protective steel covering is recommended. This is manufactured in 6-ft. lengths and is particularly suitable for supporting cables across ceilings.

The joint boxes used on the "Nomet" system are moulded from a composition which has high insulating properties and is

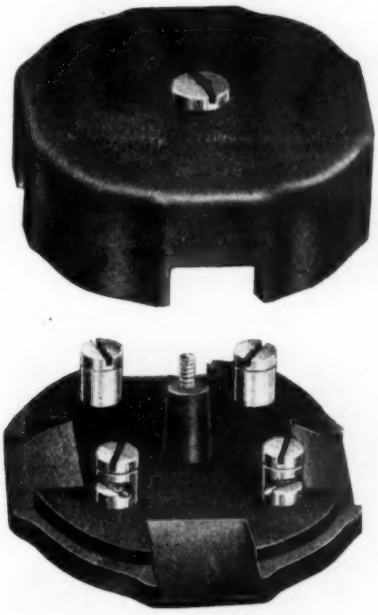


Fig. 5.—Henley 4-way Joint Box.

claimed to be moisture-proof and non-inflammable. The terminals are of the "slot-connection" type and are positioned so as to facilitate the wiring and obviate the use of loose connections. Fig. 5 shows a 4-way joint box.

For use under severe atmospheric conditions a range of fittings, "U-Seal," patented and manufactured by Messrs. J. C. White, are strongly recommended. These are all moulded from a specially prepared acid- and fire-resisting compound and embody a receptacle containing a semi-fluid compound fitted into

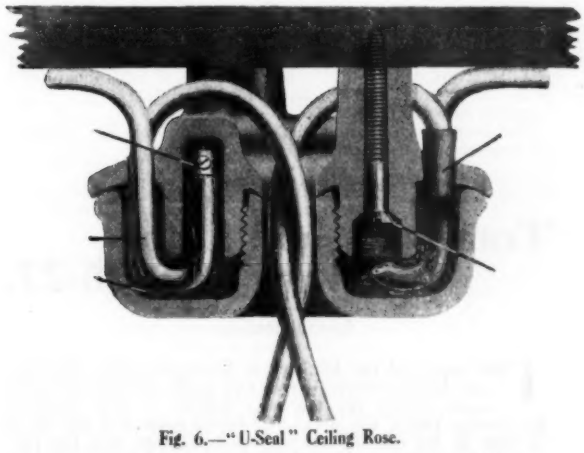


Fig. 6.—"U-Seal" Ceiling Rose.

a drip- and dust-proof cover divided into cavities for the purpose of separating the connections of differing polarity. Fig. 6 shows a sectional view of a "U-Seal" ceiling rose. Other accessories such as lampholders, switches, joint boxes, and so on, are all constructed on the same principle.

The J. & P. Non-Metal-Sheathed Wiring System.

The non-metal-sheathed form of the J. & P. wiring system is intended to supplement the metal-sheathed form. The cables used with both forms are of approximately the same size, and the same fixing clips or saddles and protective covering may therefore be employed for both. The extra flexibility of the c.t.s. cable renders it easier to avoid kinks during installation, but a little more care is needed on long straight runs to avoid sagging. An ornamental wood moulding, fig. 7, may be used to cover the cable where the appearance of a moulding would harmonise better with the decorations. This moulding is shaped so that it cannot be mis-used as a picture rail, and is fixed by means of panel pins driven in at a convergent angle from each side, so that they hold in plaster.

Only one type and size of joint box is required. The box, fig. 8, is hot-moulded in bakelite and has a fine finish, which adds to the appearance of any installation. Four apertures are provided for side-entry cables, the apertures being reduced

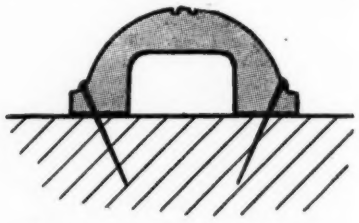


Fig. 7.—J. & P. Wood Covering.

in size to fit any cable used on domestic installations, or closed completely, by means of sliding shutters. Two blanked holes in the base can be knocked out cleanly and easily when a back-entry box is required. The box can be used as a neat ceiling rose by passing the flex through two holes in the centre

Fig. 8.—J. & P. Joint Box.

pillar and through a blanked hole knocked out of the cover; the flex is gripped firmly when the cover is screwed down. No loose connectors are required, four terminal posts being moulded into the base.

For excessively damp situations, or for use in corrosive atmospheres, special fittings can be provided.

Tramways and Light Railways in 1926-27.

Annual Return.

THE report of the Ministry of Transport upon tramways and light railways (street and road) and railless trolley undertakings for the year 1926-27 is now available (Stationery Office, 15s. net). The period covered is the whole of 1926 in the case of company undertakings, and the year ended March 31st or May 31st, 1927, for municipal concerns. The number of tramway undertakings dealt with is 235 (168 municipal), this being six fewer owing to lapsing of powers, abandonment, or absorption in the cases of Bristol Corporation, Kilmarnock Corporation, the Hartlepools Tramways Co., Liverpool Overhead Railway Co. (Great Crosby and Waterloo-with-Seaforth undertakings), the Middleton Tramways Co., and the Sunderland District Tramways Co. Tramway operation ceased on seven undertakings. The route mileage open for traffic was 2,554 (municipalities 1,862), against 2,602 in 1925-26. Of the total 2,530 miles was operated electrically, and of the total car-mileage run (378,750,700), 99.65 was electric car-mileage. The quantity of electrical energy used was 738,934,476 kWh. As compared with the preceding year, the car-mileage declined by 2.34 per cent., and the energy consumption by 0.79 per cent. The average fare paid per passenger journey fell from 1.43d. to 1.42d.

The financial section shows that the total paid-up capital of local authority undertakings was £80,093,312, of which £42,166,917 had been redeemed or provided for, leaving a net capital liability of £37,926,995 (against £37,149,639). The companies' paid-up capital was £21,079,385, and the net capital liability £19,961,096 (against £20,091,060). The total capital expenditure at the end of the respective years was: Municipalities, £78,790,595; companies, £19,819,910 (against £76,761,999 and £19,898,087), making a total of £98,610,505, as compared with £96,660,086.

The gross receipts of the local authorities fell from £23,918,622 to £23,060,376, and the working expenses from £19,009,122 to £18,793,121; thus the net receipts declined from £4,909,500 to £4,267,255. The equivalent figures for the companies were: Gross receipts, £3,856,159 (£4,292,753); working expenses, £3,335,340 (£3,589,495); and net receipts, £520,819 (£703,238). The combined figures were therefore as follows: Gross receipts, £26,916,535 (£28,211,355); working expenses, £22,128,461 (£22,598,617); and net receipts, £4,788,074 (£5,612,738). The ratio of working expenses to gross receipts rose from 79.47 to 81.50 per cent. in the case of municipalities, and from 83.62 to 86.49 per cent. in the case of companies, the combined ratio rising from 80.10 to 82.21 per cent. The amount received from the rates by the municipal undertakings rose from £418,933 to £655,242, while the amount contributed to the rates fell from £342,049 to £334,080.

The net income of the 156 operating municipal undertakings was £5,086,490 (against £5,646,787). Appropriations were as follows:—Interest on capital, £1,746,655; capital redemption, £1,899,115; income tax, &c., £692,765; reserves, &c., £1,227,290, leaving a deficit of £529,335 (against £211,135 in 1925-26). In consonance with the usual practice, the undertakings are classified according to financial results. The number of undertakings which showed a credit after meeting all charges (including capital redemption and reserves) fell from 104 to 82. Undertakings which, after meeting all charges, made reserves in excess of the amount available from working rose from 7 to 14. Nineteen undertakings (against 15) were unable to meet income tax and other appropriations in full; 17 (against 18) were unable to meet full redemption charges; 13 (against 6) could not meet the whole of their interest charges; and 9 (against 11) were unable to meet their working expenses.

The analysis of receipts and expenditure per car-mile show that the gross income of the municipalities fell from 17.70d. to 17.32d., and that of the companies from 16.13d. to 15.70d., giving a total of 17.07d. against 17.44d. The working expenditure increased as follows:—Municipalities from 14.07d. to 14.11d.; companies from 13.49d. to 13.58d.; total, from 13.97d. to 14.03d. The net receipts were thus reduced from 3.63d. to 3.21d. in the case of local authority undertakings, from 2.64d. to 2.12d. for companies and from 3.47d. to 3.01d. over all.

The returns relating to railless trolley undertakings show that 19 local authorities and one company actually carried passengers, as compared with 18 local authorities and one company in 1925-26. Twenty-one municipalities did not exercise their powers. The accession of three undertakings, viz., Darwen, Doncaster, and Hartlepool, was balanced by the discontinuance of the Aberdare, Halifax, and Oldham undertakings; the additional authority was Grimsby Corporation. The route-mileage open for traffic rose from 68.36 to 87.04 (municipalities 84.13), and the number of passengers carried from 33,703,703 to 50,382,193 (municipalities 49,693,627). The municipalities showed a ratio of working expenses to receipts of 86.43 per cent., and the company 156.03 per cent. While the net receipts of the municipal undertakings declined from 2.19d. to 1.84d. per car-mile, the company undertaking increased its net deficit from 0.50d. to 4.58d. per car-mile.

Full financial and other details are given of each undertaking included in the returns.

Photo-Telegraphy.

A demonstration took place at Geneva on December 8th of the reception of broadcast photographs, drawings, and manuscripts by means of new apparatus stated to cost less than the average three-valve receiver. This system, which has not yet been shown publicly in England, is an ingenious adaptation by Captain Fulton to the technique of broadcasting of a process invented by Mr. Thorne Baker, and used 15 years ago for the transmission of pictures by telephone wire between London and Manchester. The feature of the new system, which employs an electromagnetic method of synchronisation and records the images by electrochemical action, is that it can be manipulated by the average listener and thus differs from the more complex systems which, so far, have been used only for point-to-point transmission. Captain Fulton, says *The Times*, had both the transmitting and receiving apparatus in full view of his audience. The electrical impulses from the transmitter were relayed by telephone lines to the Geneva broadcasting station, some five miles distant, and the signals from that station were received in the demonstration hall on an indoor aerial. Under their influence the receiver traced with striking fidelity a counterpart of the original photograph. A portrait of postcard size was broadcast and received in four minutes, the middle tones being surprisingly well reproduced.

PICTURE TRANSMISSION AS AID TO POLICE.—The Budapest Prefecture of Police has decided to install at its headquarters transmitting and receiving apparatus for the dispatch and recording of pictures sent by wire, and smaller sets will be provided for the various district stations. Negotiations have already been opened for the supply of the necessary equipment. —*Reuter* (Budapest).

Industrial Electric Heating.

A Brief Survey of Successful Accomplishments and Various Methods of Application.

By F. S. GROGAN, A.M.Inst.C.E., M.I.E.E.

(*Extracts from Lecture before the* NOTTINGHAM SOCIETY OF ENGINEERS.)

THE transformation of electrical energy into heat energy is effected at 100 per cent. efficiency. Losses by radiation, conduction, and convection can be reduced to the minimum by the use of thermal insulating materials on the outside, but calculated losses are only true when the walls are shielded; therefore, although of great value in preliminary designs, especially in making first models of a new application, they are by no means final to secure the best efficiency. It is absolutely essential to obtain experimental data and practical tests.

Regarding the relative costs of operation at present-day prices:

1 lb. of coal yields:	13,000 B.t.u.
1 cu. ft. of gas yields:	500 B.t.u.
1 kWh of electricity yields:	3,411 B.t.u.

With coal at 20s. per ton, gas at 4s. per 1,000 cu. ft. and electricity at ¾d. per kWh, we have to face the fact that, strictly on a B.t.u. basis of comparative cost, gas is 7½ times more costly than coal, and electricity 2¼ times more costly than gas, but this initial unfavourable aspect has been overcome by efficient and satisfactory apparatus.

One of the most well-known applications is found in electric welding, which has been adopted in large and small factories, yielding cheaper methods of production. The original Heroult electric-arc furnace was built nearly 50 years ago and the same system is in use to-day. Swindell electric furnaces manufactured in Pittsburg after going through many stages of improvement were finally put on a thoroughly practical working basis a few years ago; they are offered in capacities of from 100 lb. to 45 tons for the manufacture of steel and iron castings, alloy and special steels, and it is claimed that in the case of the first installation put into operation two years ago not a single case of a broken electrode has been reported. Two cylindrical tipping furnaces on an electrically-operated turntable are located adjacent to the pouring pit; a steel mast carries the vertically-suspended electrodes which are electrically raised and lowered at high speed, separately chambered high- and low-voltage switch rooms feeding through overhead flexible couplings the electrodes which can be lowered into each furnace. First, both are charged and the turntable moved to the melting position and interlocked to prevent tipping during the melting; when ready, the turntable is moved a half revolution, thus bringing No. 1 furnace ready to tilt and the No. 2 furnace already charged under the electrodes; a master switch then simultaneously tilts No. 1 furnace and lowers the electrodes into No. 2 furnace. When pouring from No. 1 furnace is finished, any furnace lining may be replaced and it is re-charged and pre-heated with oil ready to repeat the cycle of operations. To indicate how perfectly this arrangement works, the period from switching off furnace No. 1 to switching on No. 2 is only one minute 20 seconds.

The latest large steel plant is at Canton, Ohio, U.S.A., where five smaller arc furnaces have been replaced by two 25-ton furnaces, each fed with 7,500 kVA, and one 7½-ton arc furnace fed with 3,000 kVA, the overall radiation losses being 275 kWh per ton in the case of the old plant against 165 kWh per ton in that of the new plant: the total overall power consumption of the new plant is 600 kWh per ton against 755 kWh formerly.

Another type of arc furnace has been standardised for brass melting; it has been established for ten years and the makers claim to have installations representing over 60 per cent. of the brass electric melting load of the United States. The furnace is a robust cylinder lined with special refractory material in five sections, horizontally supported on rollers to impart a rocking motion during heating, which thoroughly mixes the alloy and keeps the temperature uniform. Perfect temperature regulation (so essential to brass) can be obtained, thus preventing waste by volatilisation. Two electrodes operate through openings in the ends and, there being only two poles, a 3-phase supply cannot be balanced on each furnace as in the case of steel furnaces having 3 electrodes passing through the roofing; it is, however not unusual to have several plants operating in the same foundry, when the load could be balanced.

Reviewing some 70 furnaces actually installed, I find the maximum size in use appears to be of 2,000 lb., taking 325 kVA: the standard sizes are:—

Weight of charge.	Elecl Load.	Weight of charge.	Elecl. Load.
200/250 lb.	75 kVA	1,300/1,600 lb.	250 kVA
350/400 lb.	100 kVA	1,800/2,000 lb.	325 kVA
800/1,000 lb.	200 kVA	2,500/3,000 lb	350 kVA

Actual operating cost data of two typical installations are:—

750 to 1,000 lb. capacity furnace in a valve foundry: Production=8 heats, 3¼ tons in 9 hours; power consumption=325 kWh per ton at ¾d., £1 0s. 4d. Total cost per ton of brass melted, £1 17s.

300 to 350 lb. capacity furnace in a brass foundry producing high-quality pressure castings: Production=4,550 lb. in 8 hours, 570 lb. per hour; power consumption=3.5 kWh per ton at ¾d., £1 0s. 11d. Total cost per ton of brass melted, £2 4s. 2d.

When special high-grade steel, say, silicon steel, is melted electrically, an electric induction furnace keeps the metal free from any possible contamination with the carbon off the electrodes. The principle is that of a special transformer having a primary winding with an iron core built so that it is embraced by the circular channel-shaped melting chamber, the actual metal in the chamber forming the secondary circuit; current may also be passed through the metal direct to assist the heating.

A small type of high-temperature furnace is manufactured in this country under the Wild-Barfield patents. The heating units consist of bars of re-crystallised carborundum, which are suitable for temperatures of from 1,800 to 2,500 deg. F.; special spring connections are necessary to make contact, the bars running in grooves in the refractory linings. Such furnaces are suitable for melting high-speed steel, special forms of melting charges in crucibles, the baking of porcelain, and "biscuiting" of pottery ware. One form of this furnace employs a double heating chamber: the lower one for preheating high-speed steel, and the upper one for finishing off at higher temperature. There are numerous other applications. Heating elements are generally standardised at certain loadings to be easily replaceable. The grid type has given excellent service in the leather trade; I designed it for the British United Shoe Company, of Leicester, to apply to its shoe drying cabinets; it is practically everylasting. In any drying process circulation of air is of primary importance, but by heating the air the time for the drying process is decreased, for by raising the air through 20 deg. F. its capacity for absorbing moisture is trebled. In this case, in order to prevent damage to the leather we were limited to a maximum temperature of 90 deg. F. Several plants have been standardised: No. 1 size has six 1-kW standard grids through which the air is forced by a blower through continuous ducts leading to the drying cabinets and back through the blower. An inlet near the blower is arranged to admit a definite percentage of fresh air, which prevents the hot air becoming saturated. Thermostatic control regulates the temperature to a maximum of 90 deg. F., and re-circulation keeps the running cost down to a minimum. Varying standard sizes are arranged to deal with any output from one to 20 thousand pairs of shoes per week, but the great point is that the apparatus will remove all moisture that is contained in any shoe within an hour.

Whatever the cost (in reason) the certainty of the result and saving in time must cheapen the overall cost of the product. As an example I quote actual working costs obtained in practice from two installations:—

(i) At Leicester.—Capacity of plant, 12,000 pairs per week. Motive power and heater both electric. Running costs per week: Power, 3s. 9d.; fuel, 11s. 11d.; interest and depreciation, 11s. 7d. Total cost, 27s. 3d., or 0.32d. per dozen pairs of shoes.

(ii) At Northampton.—Capacity of plant, 10,000 pairs per week. Motive power, electric. Heater, hot-water boiler. Running costs per week: Power, 5s.; fuel, 11s. 6d.; interest and depreciation, 21s. 6d. Total, 38s., or 0.55d. per dozen pairs of shoes.

There must be many hundreds of applications of electric heating to industry not yet in use which would help trade generally if adopted; some involve the expenditure of large capital, and others are of negligible first cost and low running cost. An example of the latter is a simple heater similar to a kettle element, taking only about 80 watts, or a consumption of only 1 kWh in 12½ hours; result, the production of a cheap elastic webbing covered with artificial silk—all previous efforts had failed. Again, in boot machinery, small cartridge electric-heating elements are inserted into ¼-in. holes drilled out in parts of the framing over which the thread passes for local heating only, to facilitate easy working.

The following is a summary of the advantages of electric heating: (1) Absolutely positive and when necessary, automatic temperature control; (2) resulting in large saving in costs due to certain reduction in rejects; (3) a more perfect product with certain repetition of results; (4) maintenance much less, especially when considered against combustion furnaces; (5) saving in labour and floor space; (6) high thermal efficiency and ideal shop conditions; (7) even when the actual fuel cost is greater, the overall production cost is, in many cases, less.

Squirrel-Cage Induction Motors.

A Review of the Means of Improving their Starting Performance.

By D. B. HOSEASON, A.M.I.E.E.

(Extracts from Paper read before the INSTITUTION OF ELECTRICAL ENGINEERS.)

ALTHOUGH unchanged in general appearance, the induction motor has been considerably improved in design and manufacture. The introduction of ball and roller bearings has enabled smaller air-gaps to be employed and machines with long cores and small diameters to be manufactured without difficulty, and have thus led to higher power factors and higher efficiencies, by reason of the smaller magnetising current and the higher ratio of active to inactive copper. Other constructional improvements aid the production of machines with such a variety of characteristics that the field of application of the squirrel-cage motor has been increased many times. The advance has been so rapid of recent years that many engineers not directly concerned with manufacture have lost touch with these developments; this has led to the unnecessary continuance of restrictions by electricity supply engineers and the failure of users to buy the most suitable equipment, largely because the facts have not been made clear to them.

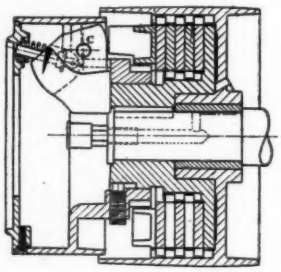
An improvement of efficiency would reduce the power bill; hence the user would be justified in paying more in first cost for higher efficiency, and the case for the efficient motor is so emphatic that it is unfortunate that manufacturers do not take some steps to educate the great number of non-technical users now buying largely on first cost; much criticism has been levelled against consulting engineers for restricting progress, but they do undoubtedly prevent users buying blindly on price. It is much more difficult to deal with the question of reliability: highly organised works with a full quota of spares can limit a breakdown time to 6 or 8 hours, but an average time seems to be of the order of 26 hours, or 1¼ working days; the number of straight accidental breakdowns in an average factory appears to be between 0.5 and 1.0 per cent. per annum of the total machines installed. These figures indicate that in the annual running cost an insurance charge should be included, so that if it were possible to increase reliability it would be worth greater initial cost in most cases. In certain industries motors are used which in the event of their breakdown would stop 75 per cent. of the production: in the case of these machines the insurance charge would be very considerable and might even become a greater sum than the interest charged on the motor, thus justifying a complete spare machine mounted in position with a throw-over clutch with which to carry on in the event of a breakdown of the first motor.

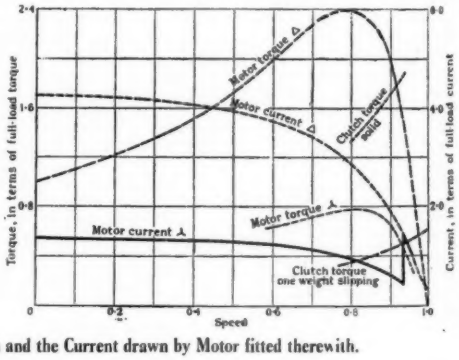
The squirrel-cage motor has usually both a higher efficiency and a higher power factor than the corresponding slip-ring motor, and for general industrial work is a more profitable investment than any of the alternatives available. On the score of reliability it again has very distinct advantages; breakdowns of machines are distributed 63 per cent. on armatures, commutators, slip-rings and brushgear, with only 37 per cent. elsewhere. hence it would seem that the squirrel-cage motor has a "probability of breakdown" of about 45 per cent. of that of electrical machines in general. The squirrel-cage motor is the cheapest available; even when employed with an auto-transformer starter it shows a substantial saving over a slip-ring motor and starter. The case for installing squirrel-cage motors is such that minor advantages of other types are frequently outweighed: their field of application is, however, limited to drives requiring a constant speed, or a group of two, three, or four constant speeds such as is obtained from pole-changing and two-winding squirrel-cage motors; a further limitation is their starting performance.

Probably the earliest method used to overcome the starting difficulty of the squirrel-cage motor was to employ either a clutch or a loose pulley to reduce the torque required at starting and thus enable some form of starter to be used which diminished the current drawn from the mains; although their price brings the cost of the squirrel-cage equipment very close to that of the slip-ring, their use is often justified on the strength of the greater reliability and higher efficiency of the squirrel-cage motor.

A recent development of centrifugal clutches consists of plates which are pressed together by weights normally held out of operation by springs (see fig. 1): when the clutch is "out" the centrifugal force of the weights is taken largely by the bearing pins (c) and only a small amount is balanced by the springs; when "in," the system of leverage brings considerable pressure to bear on the plates and only a small proportion is wasted in compressing the springs. Consequently, the speed at which the weights operate can be made much higher than in the case of the spring-controlled clutch; in fact, it is possible to accelerate to over 98 per cent. of synchronous speed with this clutch before throwing any load on the motor. A further advantage is that by arranging one of the three weights to operate at a lower speed than the other two the motor can be made to float at some predetermined speed in the "start" position of the starter. The pressure on the plates exerted by the one weight is not sufficient to make the clutch solid, but is enough to cause the clutch to exert a braking effort and to keep the motor floating at a speed just below full speed. When the change-over from the starting position to the running position is made, the increased torque available raises the floating speed. The two remaining weights are set to operate somewhere between these two floating speeds, and the change from starting to running position is sufficient to bring them into action and to result in the load being thrown on the motor. Fig. 2 shows the current taken by a motor fitted with this clutch when starting against full-load torque with a star-delta starter.

The characteristics of high-resistance rotors for both continuously-rated and short-rated motors are discussed, various other devices for improving starting performance are reviewed, and the advantages of the double squirrel-cage rotor over many of the alternatives are pointed out; it is a most ingenious device and, with proper adjustment, can be made to produce highly successful results. Its cost is from 5 to 10 per cent. higher than that of a single squirrel-cage machine; however, the increase is offset by the cheaper starting gear when star-delta starting is employed in place of auto-transformer starting. When the use of the double squirrel-cage rotor enables a squirrel-cage machine to be employed where otherwise a slip-ring motor would be necessary, a saving is made both in the cost of the motor and in the control gear, and may be a considerable amount. In the ordinary single squirrel-cage motor the designer has to strike a balance between high starting torque (necessitating high rotor resistance) and high efficiency (requiring a low rotor resistance). In the double squirrel-cage motor special provision is made for obtaining the starting torque, and consequently the running winding can be made of lower resistance than would normally be desirable, hence the efficiency of the machine can be made higher than that of the single squirrel-cage motor. The commercial possibilities of the double squirrel-cage rotor are considerable and the sacrifice in power factor is nothing like as serious as has been suggested.





Figs. 1 and 2.—Plate Clutch and the Current drawn by Motor fitted therewith.

All necessary control can be obtained on the majority of cranes with a squirrel-cage motor having a high-resistance rotor. The motor is put direct on the supply and fine operation obtained by "inching," simply throwing the motor on and off the supply. This is distinct from "creeping," such as is obtained with "divertor control" on d.c. series motors, and should not be confused with it. The success that has been obtained with these motors demonstrates the soundness of the scheme. To overcome the difficulty of heating, the high resistance is located in one end-ring at the fan end of the motor. A system of baffles prevents any heat from this end-ring getting on to the stator coils, and a stream of air is projected over the end-ring and immediately out of the machine. It is thus possible to have this ring working at any temperature up to red heat without damage to the rest of the motor.

Close examination of the starting currents drawn by squirrel-cage motors under various conditions of starting is made from the point of view of the supply engineer.

Records of the current peaks on various feeders are given, the characteristics of every motor on each feeder being known. Additional records show the effect of the diversity factor for these current peaks on the current of the transformer supplying several feeders, and on a complete sub-station. Finally, the regulations of certain supply undertakings for the installation of squirrel-cage motors are examined, and the following general regulation is evolved :—

"The starting current of any of the induction motors in an installation, when expressed in terms of full-load current, must not exceed—

$$\frac{3}{4}+(\text{total installed h.p.}/4\times\text{motor h.p.}).$$"

Discussion in London.

Mr. F. CREEDY was pleased that the author had emphasised the importance of efficiency, and suggested that the proposed general regulation governing the installation of squirrel-cage motors should take account of the power factor by means of an appropriate formula. The author's statements with regard to reliability were very interesting. It seemed to him that the cascade machine had a considerable future, and he would communicate details of the modern type to the I.E.E. *Journal*. The invention of the double squirrel cage motor had clearly been before its time; did not the high-resistance winding tend to become hot, as it was continuously in circuit? He had found some burned out. Although absence of shock when changing speed was a real advantage, prejudice prevented "multi-speed" motors being used more often than they were in place of "continuous-speed" machines.

Dr. R. G. JAKEMAN thought that the paper indicated the resurrection of the type of motor described, which would be used more in future. He agreed with the suggested equation governing installation, and also that it should depend on the total installed h.p. The shock to which gears, &c., were subjected by starting large motors direct could be overcome by the insertion of starting resistances. A difficulty that would be experienced with the new clutch (fig. 1) was that it required to be very carefully adjusted so as to operate at the correct time. The author had not made out quite so good a case for the double squirrel-cage motor as he might have done.

Mr. W. E. ROGERS stated that ball bearings were an abomination to the practical man, as no effective means had been devised for fixing the inner ball race to the rotor shaft. What virtue was there in an indestructible rotor when it had to be put into, and depend on, a very destructible stator? Electric arc welding and improved methods of brazing were classed as constructional improvements, but they did not facilitate repairs. He would always place reliability first, followed by price; efficiency was a very fine thing for designers, who were enthusiasts. The term "starting current" was very frequently misunderstood by manufacturers, and what was really meant was "initial current." No mention had been made of single-phase machines: he was on a single-phase system, and hoped to remain there for some years before he was placed on the "grid." Star-delta starters were no good, which fact forced one to employ auto-transformers. He had recently tried a new type of starter, known as the "Inductorstat," which consisted of an auto-transformer or choke in each phase, which had enabled motors to be started with very little, if any, disturbance to the line, a mere flicker of the ammeter pointer.

Mr. D. J. BOLTON said that efficiency mattered very much to the user, and reliability to the maker. What a machine cost was as important as what it did; 1 per cent. better efficiency would be worth while if it could be purchased for anything up to one-third of the cost of the motor and starter. Could it be obtained, and how? Preferably by the use of a larger machine of the same make, say, 60 h.p. instead of 50 h.p. Auto-starters having several tappings would be useful, so that one could go through one to the other.

Dr. F. J. TEAGO pointed out, with reference to the author's group of speed-torque curves obtained with a four-step controller and resistance used with a double squirrel-cage crane motor, that that combination would not provide any torque at any speed; the arrangement could not be described as a variable-speed motor, but as a variable-torque device.

Mr. H. K. WHITEHORN explained that the author had not shown the effect of star-delta starting on design, which was marked. Nothing simpler than the squirrel-cage machine with one bar per slot could be imagined; it was the "ideal" motor, and should become universal, especially if provided with an indestructible stator.

Mr. J. ECK remarked that starter makers had not taken part in the discussion; starters added to the cost of motors without affecting their reliability. Supply engineers had also remained silent, though boldly attacked by the author. He attributed each grey hair on his head to a single-phase motor. Power factor had not been over-emphasised, and he hoped that efficiency would be kept to the fore. What was a satisfactory pattern of ball bearing to put into the layman's hands?

Mr. W. WILSON said that direct starting had been spoken of as though it were desirable, if the supply authorities and nature of the load permitted. Could it be done without risk of damaging the motor?

Mr. J. H. MEACOCK, who said he was interested in lifts, asked if an even number of slots would affect the noise of starting and running a motor?

Mr. D. B. HOSEASON, in reply, exhibited a curve (percentage of motors sold) to indicate that the squirrel-cage machine was not getting its fair share of work. The high-resistance winding did not tend to overheat, and the largest directly-started motor they had installed was a 135-h.p. pump set in South Wales, which had braced end-windings, but not to such an extent as turbo-alternators; they had quoted for 300-h.p. directly-started machines. He was closely watching the tendency towards resistance starting in the U.S.A., as that method was likely to develop. Power engineers should not complain of increased current and low power factor; they could have either, he did not mind which, but not both simultaneously. Ball bearings had come to stop, and suitable patterns allowed of the motor being taken to pieces without difficulty. He was not aware that the initial current mattered when starting, but the maximum current was of importance. Double squirrel-cage machine windings were not insulated because the voltage was so small. Several thousand such motors were in use, mostly in this country; the first had been in service for three years, and not a single rotor had been returned; in fact, they had given less trouble than normal machines. They were very quiet, because the zig-zag leakage across the slots was reduced. Such motors were not being used to anything like the extent they could, and should, be; it was high time they removed some of the self-imposed restrictions to electrical development.

Selected Radio-Telephone Apparatus.

Recent Developments and Improvements.

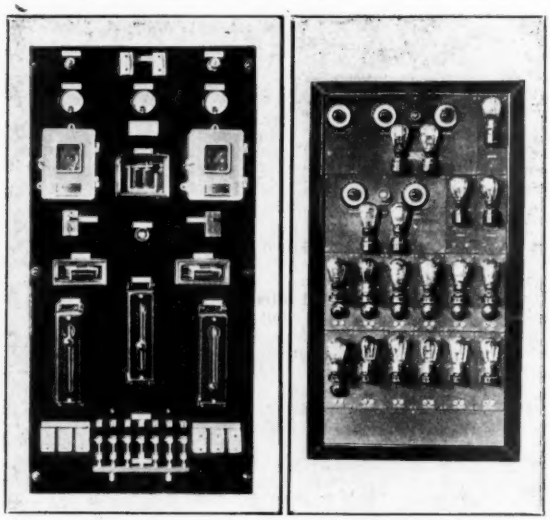
Lambeth Hospital Installation.

The wireless installation at the Lambeth Hospital, London, is probably unique in this country. It is automatically switched in and out, choosing programmes from London and 5GB at the most suitable times with no human attendance whatsoever while it dispenses entirely with batteries. Reception is carried out by two separate aerials and receivers, one tuned to London and one to 5GB. Owing to the proximity of the former station the second instrument incorporates a series rejector and one high-frequency stage with loose coupling. From the receivers signals are fed into the preliminary amplifying panel, consisting of two resistance-capacity coupled valves of the DE.5 type, and then into the main bank of seven DE5A valves for the head-telephone circuits and also to an additional single stage which in turn feeds the speaker bank of five LS.5A valves (figs. 1 and 2). Each valve supplies one circuit through its own special line transformer, thus ensuring full operating efficiency by matching the output impedances and enabling the load to be balanced very evenly, an additional advantage is that the anode current does not reach the line, and patients are therefore protected from any possibility of shock, while the absence of "standing" current also prolongs the useful life of both headphones and loud-speakers. Every circuit has an individual volume control on the main panel, as well as a pair of sockets which may be used for checking the strength if desired. Since the number of telephones in use is always large, there is no necessity to compensate for any which may be disconnected individually, but each ward has independent volume control and a compensating resistance which is switched in when they are out of circuit thus inserting an equivalent load and maintaining a constant output from the others supplied by that particular feeder; each loud-speaker point is similarly treated. The total capacity of the installation is up to 2,000 pairs of headphones and 80 speakers, but at the moment approximately 400 and 67, respectively, are in use. The wiring is twin lead-covered cable throughout, the casing being bonded and earthed, the total length of wire exceeding 9½ miles.

The supply of power for the equipment is obtained from duplicate Crypto motor-generator sets, each consisting of an a.c. self-starting motor directly coupled to a double output d.c. generator giving 200 milliamperes at 310 volts for anode and 10 amperes at 10 volts for the filament circuits. The machines have been specially made, with particular attention

to armatures, commutators and brushes, the latter being of the Admiralty pattern. The whole is extremely robust, and a multiple switch makes it possible to place either in use at a moment's notice, providing an adequate factor of safety and reliability.

The control system is claimed to be altogether unique. In addition to the necessary voltmeter, resistances, fuses and field regulator, the control panel carries two time switches, three relays, and two pilot lamps, which function together as the mechanical and electrical "brain" of the installation. At 12 p.m. time switch No. 1 "makes," operating the relay which starts the motor-generator equipment, switches on the London receiver, and lights the London pilot lamp as an indication that all is well. At 2 p.m. the time switch "breaks" and the equipment closes down. At 3 p.m. time switch No. 2 "makes," and operates the starting relay, which again starts the generator, but switches on the Daventry receiver and lights up the Daventry pilot lamp. At 5.55 p.m. the equipment is closed down. At 6 p.m. time switch No. 1 again "makes," and keeps the London programme



Figs. 1 and 2.—Lambeth Hospital Radio Panels.

on until midnight, when it closes down the equipment until twelve hours later. The only attention required in the normal course of events is for the rewinding of the time switch clocks once a fortnight. In the steward's office, which is approximately 100 yards distant from the equipment, there is a small wall cabinet containing three-way switches which enable him to carry out the following operations:—(1) Shut down the whole equipment; (2) start the generator and amplifiers, but not the receivers, at any time when the wireless programme is not available; (3) interrupt the wireless programme by disconnecting the receivers, but not the amplifiers and generator. Having carried out (2) or (3) he can then (4) make announcements through a microphone in his room; (5) play gramophone records through a Marconiphone electrical pickup; and (6) throw into circuit microphones in the chapel or the dining hall for the purpose of relaying services and musical entertainments respectively to the whole hospital. Although the Marconiphone Company has carried out previous automatically-controlled installations, the equipment of the Lambeth Hospital probably has no parallel in the world.

"Amplion" Cone Speakers.

Messrs. Graham Amplion, Ltd., have received a considerable number of inquiries as to why two distinct types of cone speakers have been placed on the market, *i.e.*, the "Senior" models and the "Junior" series. Their explanation is that when visualising the market as manufacturers of loud-speakers only, they had to bear in mind that they had no knowledge, specifically, of the type of set with which their instruments will eventually be associated. Therefore, they decided to classify radio sets, from their point of view, roughly into two groups: first, those giving ample volume and probably using plenty of anode current and a "super-power" valve in the last stage; to meet this class, the "Senior" models were evolved, and their seamless fabric diaphragms will not "rattle" when driven by a powerful set of good design, although loaded in excess of the requirements of the average user. In the other category is the inexpensive two- or three-valve set with only normal battery power, in combination with which the "Junior" cones will give satisfaction for the man who has but little to spend.

The Company's latest product is illustrated in fig. 3, which shows it to be of the open cone variety made for hanging on a wall, or from a picture rail. The method of construction is that of the fixed-edge cone and the frame is composed of a synthetic material, similar to bakelite, whilst the back-board is made of wood. The cone is clamped between this and the frame. The cone is fitted with an adjusting nipple and tinted to harmonise with the rim, which is brown. Although it is rather smaller than the other "Junior" models, being only 9 in. in diameter, it is operated by the standard movement. Cords of heavy silk material are supplied for hanging the instrument, the overall diameter of which is 13¼ inches. Our sample has functioned very satisfactorily.

Some Ferranti Products.

The operation of large loud-speakers without overloading the valves involves the use of super-power valves and high anode voltages. Capt. P. P. Eckersley recommends the use of at least 300 volts on the plates and amplifiers have been made up of super-power valves in parallel with 900 volts on the anodes and about 150 volts grid bias. However, if not dangerous, such voltages are not yet quite practicable for the ordinary user, and the difficulty may be overcome by the employment of the "push-pull" amplification arrangement. Suppose the last low-frequency stage requires two power valves with their filaments in parallel; the audio-frequency

Fig. 3.—A.C.2 Hanging Cone Speaker.

transformer feeding them has one end of its grid winding connected to the grid of one of the valves and the other end to the grid of the other valve; the mid point is connected *via* a suitable grid-bias battery to the negative end of the filament. In a similar manner the two plates of the valves are connected to the opposite ends of the primary winding of the output transformer, the mid-point of this transformer being connected to the h.t. positive giving 120 volts or more. The secondary side of the output transformer is connected to the loud speaker in the ordinary way. Thus the division of the signal from the first l.f. valve (one-half going to each of the two valves in parallel) provides the equivalent of double the normal grid swing permissible when using only one valve, without distortion; that is, a much louder signal may be handled without distortion due to valve overloading. The range of "push-pull" transformers marketed by Ferranti, Ltd., are similar to their ordinary types, except that they are provided on their primary and secondary sides with centre tappings, and in consequence the windings are suitably increased. The audio-frequency patterns have a ratio of 1 to 3.5, and the output types ratios of 1 to 1 and 2¼ to 1. Other new products of the Company include chokes and fixed condensers for use in the "smoothing" circuits of battery eliminators and receivers.

A New "Orphean" Speaker.

The London Radio Manufacturing Co., Ltd., has sent us a sample "Orphean Gem" speaker which stands 19 in. high, the diameter of the horn flare being 10 in. This British-made instrument is therefore almost of full size, and its price is very reasonable. Of 2,000 ohms resistance, adjustment can be made by means of a knurled knob; the moulded and polished bakelite base is chocolate in colour, the flare and swan-neck being spray enamelled to suit.

The "Irwell" Detector.

Some months ago Mr. A. Hinderlich (Quartz Oscillators, Ltd.) sent us a sample of his "Irwell" crystal detector—a simple device consisting of an adjustable spring lever, mounted on an ebonite base, and carrying at its free end a crystal which is applied to a corresponding crystal mounted in a fixed cup. The crystals used form the combination styled the "ghane," and performs very effective rectification; apparently every point of contact is equally efficient, and it has given excellent results in combination with one h.f. and one l.f. valve, requiring no attention.

The Marking of Imported Cables.

Merchandise Marks Act Inquiry.

AN application for an Order-in-Council under the Merchandise Marks Act, requiring that imported insulated electric cables and wires should bear an indication of their country of origin was the subject of an inquiry which opened on December 12th, by the Standing Committee appointed by the Board of Trade. The Committee consists of Sir Llewellyn Smith (chairman), Mr. F. R. Davenport, and Mr. G. N. Barnes. The application was made by the Cable Makers' Association, which was represented by Mr. R. Moritz, K.C., and Mr. F. N. Keen. It was supported by the Independent Cable Makers' Association (represented by Mr. Bernard Faraday), and by the Metropolitan Electric Cable and Construction Co., Ltd. (represented by Mr. C. C. Strong). The only opposition was that of the Electrical Importers' and Traders' Association (represented by Mr. N. L. Macaskie).

Mr. R. MORITZ, K.C., said that the three applicants together represented an overwhelming proportion of the cable manufacturing industry in the United Kingdom. The C.M.A. consisted of 18 members, whose aggregate capital was approximately £12,000,000. There were certain other cable makers outside the Association, with an aggregate capital of £700,000, some of whom were members of the Independent Cable Makers' Association. There were very few cable makers not represented by the applicants. The annual production of the C.M.A. amounted in the aggregate to £16,500,000. Four classes of goods were covered by the application. (1) Long lengths of large cross-section cable consisting of one or more insulated or weather-protected conductors; (2) small cross section cables consisting of one or more insulated conductors, such as those required for general internal wiring, for lighting or heating purposes, wound on drums, &c.; (3) coils of conductors, insulated or weather-protected, similar to those described in (2), but not wound on drums; and (4) cotton and silk covered or enamelled wires, wound on spools, bobbins, or the like. There was considerable importation of all four classes of goods; the estimated imports for 1927, based on the first nine months' figures amounted to £710,000. There was reason to believe, however, that a good deal of this material was also imported under other descriptions. There was evidence that where customers expected to get British goods they were supplied with foreign goods. It was asked that the marking of the cables and wires in categories (1), (2) and (3) should be effected by means of a continuous tape, paper or fabric extending the whole length of the cable, embedded in the insulation, and having printed on it at intervals not exceeding an inch in length, and in an easily readable and indelible form, the words "Made in," followed by the name of the country of origin. The Government of Australia required that certain cables imported into Australia should include such a tape having printed upon it prescribed information regarding the quality of the cable. Further, it had been the practice of cable makers in Great Britain to have such a tape in their cables for the purpose of indicating the origin. The applicants also asked that, in addition to the tape in the cables and wires in categories (1) and (2), the marking should be branded into the drums, &c., in such a manner that the printing could not be removed without destroying the drums. With regard to the coils under category (3), it was asked that, in addition to the tape, there should be a metal band round each coil, the two ends being fused together, and a projection integral with that band, on which there should be embossed the indication of origin, or a label, on which the indication was indelibly indicated, secured by the band so that it could not be taken off without destroying the label or the band. In the case of the cotton and silk covered or enamelled wires it was asked that the marking should be branded on the drums, &c., on which the wire was wound. The cost of marking the large class of cable, said counsel, was negligible. The cost of the printing on the vulcanising tape in the case of 1/.044 wire would be 0.5 per cent., and as the size of wire increased the percentage of cost decreased. In reply to the chairman, counsel said that in practically every case the cables and wires already contained vulcanising tape as part of the ordinary insulation. The applicants agreed to exclude all wires or cable which formed an integral part of any complete article. The proposed marking would not cause physical injury, and there was no re-export trade. Counsel said that the quantity of imports amounted to 6 or 7 per cent. of the home production. Marking had already been found practicable in Australia. The applicants proposed that the wires and cables should bear the proposed marking at the time of importation as well as at the time of sale or exposure for sale.

Mr. LL. B. ATKINSON (director of the Cable Makers' Association), supporting the application, said that the importation in 1924 was of the value of £450,000; in 1925, £608,000; in 1926, £597,000; and in 1927 (estimated) £710,000. It was impossible to distinguish British and foreign cables by inspection. Catalogues were produced advertising the imported goods in such a manner as to give the impression that the goods were British. In other cases the goods were advertised as complying with the requirements of the British Engineering Standards Association.

The cross-examination of the witness involved mentioning the names of specific firms, and that part of the proceedings was held *in camera*.

When the public proceedings were resumed, Mr. Macaskie pointed out that the members of the C.M.A. manufactured cables of "Association" and "Non-Association" qualities, and he asked why it had been suggested that it was unreasonable and deceiving for a man to sell cables which were not made by a member of the Association as being of "Association" or "Non-Association" quality. Witness replied that to the trade those words meant that the cables were made by a member of the Association. The sale of imported cables as complying with the British Standard Specification gave an impression that the cables were British-made. Counsel pointed out that the value of the annual output of members of the C.M.A. was £16,500,000. In addition to that, the value of the small cotton and silk covered and enamelled wires was about £1,000,000, and the Independent Association manufacturers were responsible for about £1,000,000 worth. The output of manufacturers outside the two Associations had also to be considered, so that the total British output would be worth about £19,000,000. He asked if it were not ludicrous to say that an importation amounting to less than 3.3 per cent. of the British production constituted anything unfair or unjust to the British manufacturers. Mr. Atkinson replied that if £5 worth of cable were imported under conditions in which the buyer was deceived, it constituted an injury to the British manufacturer. It was pointed out by counsel that the heavy cables (which constituted about 60 per cent. of the total) were bought by central station engineers, and witness agreed that those engineers would know their origin. Counsel pointed out that the seals on the ends of the cables, which preserved the insulation from damage by moisture, would have to be broken by the Customs officials in order to ensure that the cables were properly marked. Witness replied that only if it were done by a man who did not understand cables would it imperil the insulation. Counsel suggested that in the case of flex marking was impracticable. Witness did not agree, though he admitted that British manufacturers did not mark their flex. Another suggestion made by counsel was that the disparity between the prices of British and foreign goods was sufficient to indicate whether they were British or foreign. Witness replied that there were makers in this country who were selling at lower prices than the C.M.A., and they were supporting the application. The price would only give an indication that the goods were not made by members of the C.M.A.

The inquiry was adjourned until December 13th, when Mr. H. SAVAGE (works manager of W. T. Henley's Telegraph Works Co., Ltd.), gave evidence in support of the application. He said that there was nothing to prevent a foreign manufacturer matching British goods so closely as to deceive the expert and make discrimination almost impossible. The methods of marking proposed by the applicants were simple and practicable, and involved no substantial expense. He exhibited a sample of a rubber-covered cable with marks impressed on the outside of the rubber covering, as an example of an alternative method of marking. Witness considered that the stamping or embossing of a lead-sheathed cable was inadvisable. The band which it was proposed to place round each coil of wire would not chafe the insulation and damage it. Mr. MACASKIE suggested that the removal and replacing of the plumbed seals would necessitate additional skilled Customs staff. Mr. SAVAGE replied that the work could be done by a man of ordinary intelligence. He was unable to agree that the stamping of a mark on the sheath of a lead-covered cable was inadvisable because it would result in injury to the conductor.

In reply to a question by the CHAIRMAN, Mr. SAVAGE said that he was of opinion that the method of printing on the enveloping tape would be adopted where such tape existed; where it did not the insertion of a longitudinal tape would probably be preferred. The method of marking the sheath would be adopted only where the other method was not used.

Mr. C. PIPKIN (joint manager of Callender's Cable & Construction Co., Ltd.) said that while those in the industry could distinguish between British and foreign rubber-covered cables, it would be a matter of great difficulty to the ordinary electrical contractor. He saw no difficulty in the marking of cables and wires in the manner suggested. His company had recently completed a large order for Holland, in which the lead covering of the cables had been marked continuously along the whole length with an indication of the size of the conductors, the name of the manufacturers and the year; that had been done without difficulty or injury. The marking of small tough rubber cables could be done better by printing on the cores. The cost of impressing the marks on the sheaths was too small to estimate. He did not agree that the insulation of coiled wire was likely to be damaged by the metal

band round each coil. A suggestion was made by witness that a copper tape might be inserted longitudinally between the insulation and the lead sheath, for the purpose of carrying the mark; that would not cut the insulation or set up electrolytic action.

Mr. F. POOLEY (Messrs. Pooley & Austin) gave evidence to the effect that buyers as a rule did concern themselves as to whether the cables they bought were British or foreign. He would not say that firms who were selling foreign cables implied in their catalogues that the cables were British, but the catalogues did not convey to the purchaser that the goods were foreign.

Mr. WILLIAM BROWN (managing director, Metropolitan Cable and Construction Co., Ltd.) said that his company was not a member of either association. He claimed that there was not always a disparity between the prices of British and foreign cables. He produced a catalogue which, he said, would indicate to the purchaser that the cable was British whereas it was not.

Mr. JOHN BROWN (director of Messrs. Connolly's (Blackley) Ltd., and chairman of the Independent Cable Makers' Association) also gave evidence in support of the application.

Mr. WILLIAM BROWN was recalled to give evidence to the effect that the large cables were bought not only by central station engineers, but also by colliery buyers, who often did not know whether the cables they bought were British or foreign.

This closed the case for the applicants.

Mr. N D. WATSHAM (Messrs. Watshams, Ltd.), for the opponents, gave evidence with regard to foreign underground cables. He said that the buyers of these always purchased with a full knowledge of their origin. The British cable makers did not mark their underground cable in the manner which they had prescribed for their competitors. If the foreign manufacturers were compelled to adopt the proposed methods of marking the cost of the cables would be increased. Further, the Customs authorities would have to unseal the cables for inspection, which they could not do without special implements. The unsealing might result in the destruction of the insulating qualities of the cables. He suggested that the introduction of copper tape underneath the lead covering would impose electrolytic stresses in high-pressure cables.

With regard to the inspection of the cables by the Customs, witness said that he would have to send a man down to the docks to plumb up, and that would mean extra expense. The plumbing could not be done properly with solder and a plumber's blow-lamp.

The inquiry was then adjourned until Monday, December 19th.

Correspondence.

***Correspondents should forward their communications* as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

"Situations Vacant."

The article under this heading which appeared in the ELECTRICAL REVIEW for December 9th has attracted a great deal of attention among those young engineers who very properly seek to better their position. Without such ambition a young man will hardly ever improve his prospects and will remain, as he deserves, a simple cog in the wheels of industry.

The article is indeed a cry *de profundis*, and thousands will be grateful for its publication. Let me first state that the ELECTRICAL REVIEW is the most respected technical journal circulating in any electrical works. It does all in its power to protect those who apply for the situations advertised under a box number from victimisation, and if they do not avail themselves of the warning that replies will not be forwarded to particular firms when so desired, they have only themselves to thank.

The fact that copies are emasculated before being circulated to various departments is well known, but it is countered in a very effective manner. ELECTRICAL REVIEW Clubs are formed by groups of employés, each member paying so much per week so that a copy *virgo intacta* may be available for the group members. This gives them the advantage of being able to co-operate loyally in applying for such situations as may seem suitable for their abilities, together with the opportunity of reading the textual matter at leisure, each in his turn. It is quite hopeless to try to do this in a free library, particularly on a Saturday, when there is usually a queue.

Ten years ago I would have scoffed at the suggestion that British firms could condescend to such a contemptible method as the box "trap" advertisement for the purpose of getting information about secret processes used by their rivals. Rude shocks have shattered my touching faith. It is, of course, well known that a patent specification is supposed to supply sufficient information for an "intelligent mechanic" to reproduce the article described therein. This is an absolute fallacy, for it ignores technique, both in the laboratory and workshop. In this respect many specifications are as much use to the mechanic as would be a correspondence course in horse-riding or boxing. The research man, analytical or physical, knows far more than is ever set down in cold type by H.M. Patent Office.

At the time of the engineering slump—which we all remember with pain—I was employed as research engineer for a firm that was badly hit. After working for some time at a reduced salary (I had suggested the reduction myself) I found that I could not carry on, and so left on the best of terms, telling them that I should probably have to try one or more of their more prosperous rivals. Replying to an advertisement for a research engineer in a similar line of business, I received an invitation to call. After an interview with the firm's engineer I was practically engaged by this gentleman who only examined me as to my technical knowledge. I had, however, to interview a higher authority who, to my surprise and disgust, asked me if I knew how to carry out a certain process that I had developed for my former employers. He did not stop at that. He asked me to tell him about the financial position of the firm, the number of employés, the volume of business, if increasing or decreasing, and the number of contracts entered into recently. Probably the nature of my reply offended the authority, for my appointment was never confirmed. A similar request from another box number firm evoked an equally vicious reply, just when the interview was going nicely. I felt in an aura of hate, quite pleased, although I needed a job.

There is one point that your able contributor omitted, and it constitutes a very real grievance. Very probably the ELECTRICAL REVIEW warns respondents not to send original references or testimonials. The making of copies is a laborious matter, and time after time the poor copies never return in spite of a stamped and addressed envelope. Sometimes at long last they do return, but usually in so tattered and soiled a form that the only deduction is that the office boy has been using them as a pen-wiper.

Finally, I hope that no British firm has ever come down to the level of a famous American firm by which I was employed in a very important position. They inserted box advertisements offering a higher rate of pay than they were giving their own workers. Naturally there was a response from the rank and file which provided an index of those dissatisfied with their present pay. These were discharged to make way for learners at a still lower rate.

It is comparatively easy for a single man to treat such temptations as they deserve, but what of the married man with other mouths to fill and a landlord to satisfy?

L. Rutledge.

London, *December 12th*, 1927.

Overhead-Line Regulations.

According to your report of December 9th, Mr. Fennell said:—

"There should be a factor of safety for the line wires of 2, at 23 deg. F. with ¼-inch radial thickness of ice and a wind pressure of 8 lb. per sq. ft. Alongside highways and across, or over, public footpaths and public bridle roads, or across or over private roads, or within 8 ft. of them, double suspension was suggested."

The factor of safety and conditions mentioned are, of course, in accordance with the existing Regulations for low-pressure lines. He suggests, however, that double suspension should be used alongside highways, &c. The present Regulations do not ask for double suspension for low-pressure distribution lines along highways; they merely ask for a device like the Trotter "V" guard.

Apparently, Mr. Fennell wishes the Trotter "V" guard to be scrapped, but is prepared to double the number of insulators at every one of these distribution poles and provide short anchor wires from each of the additional insulators.

All the economy obtained by doing away with the Trotter "V" guard will be more than counterbalanced by the cost of this double suspension, to say nothing about the looks of the thing. If single insulators can be used for low-pressure distribution lines under the present Regulations, why should we ask for them to be doubled?

By all means let us have the Trotter "V" guard done away with, but for goodness' sake don't let us ask the Electricity Commissioners to double all the insulators on low-pressure distribution poles which run along highways and streets.

J. A. Morton.

Huyton, *December 9th*, 1927.

Stokers v. Pulverised-Fuel Furnaces.

The first instalment of Mr. Pausey's article seems to have a gap in its argument. It assumes that if the CO_2 percentages are identical for stoker and pulverised-fuel firing, the temperature of combustion and—therefore—the proportion of radiant heat will also be identical. It seems to me that the pulverised-fuel flame must be at the higher temperature, under the best conditions of air supply and equal CO_2 percentages. I assume that equal CO_2 percentages are attainable. With the stoker furnace the main radiation is from the surface of solid fuel which is at a lower temperature than the flame. There will be some flame, but the pulverised fuel is all flame.

Mr. Pausey is right in advocating higher combustion chambers for stoker furnaces. In this he follows the late W. H. Booth, who, in the columns of the ELECTRICAL REVIEW and elsewhere, for years urged the provision of larger combustion spaces, and such furnace design as to ensure the completion of combustion before the gases impinge upon any water-cooled surfaces. This can be realised in a stoker furnace, but I am not sure that so high a percentage of radiated heat is possible as in a pulverised-fuel furnace.

The stoker may give as high combustion efficiency and CO_2 percentage but the distribution of the heat produced, between radiant and gas temperature forms, is likely to be different.

I cannot compare the amount of skill and attention necessary to maintain high efficiency under working conditions, for my experience is limited to the stoker type; it looks as though the job is easier with pulverised fuel.

Henry M. Sayers.

London, *December 13th*, 1927.

Accumulative Anode Detection.

The following lines concern the article written by Mr. E. W. Braendle in the ELECTRICAL REVIEW dated December 9th, 1927: Mr. Braendle assumes in his article that rectification is dependent on a straight-line function and not on a "bend." That is impossible, for if the valves are both used on a straight part of the anode current-grid voltage curve, without grid currents, then the whole circuit contains only resistances following Ohm's Law. It is one of the most fundamental things that rectification of alternating current can only take place in a part of a circuit where Ohm's Law is not valid. The first and the second valves can both give anode detection, as there are no exactly straight parts on a valve characteristic, especially in the lower parts where the valves are used.

J. Jansen.

London, *December 14th*, 1927.

33,000-V Cable Testing.

In his letter in your issue of December 16th, Mr. M. C. Timms states that there is no known connection between IR with d.c. and dielectric loss with a.c. It may be that there is no *known* connection, but I claim that for many possible, and some actual, cable impregnating mixtures there is a connection between the two. My experience is that the IR falls as the losses increase, and I believe most people will agree with the statement in that general form. Perhaps Mr. Timms knows of exceptions amongst this class of substance, in which the IR rises with increasing losses? Probably the time is not yet ripe for the IR test to be accepted, but I think modern research is tending to give it a greater significance than it has at present.

F. Fernie.

London, *December 16th*, 1927.

The Economic Choice of Induction Motors.

With reference to Mr. A. G. Powell's article in your December 16th issue, we assume he refers to a 10-h.p., 6-pole, 400-volt, 50-cycle, squirrel-cage motor. If this is so, our test figures show an efficiency at full load of 87.5 per cent.; ¾ load, 87.5 per cent. Power factor, full load, 87 per cent.; ¾ load, 82 per cent. We are therefore prepared to guarantee an equal performance to that stated in the article, and our trade price for this machine is £15 6s. How would Mr. Powell explain this?

Higgs Motors, Ltd.
(WALTER F. HIGGS.)

Witton, Birmingham,
December 16th, 1927.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1926.

15,810. "Driving of carding-sets." Siemens-Schuckertwerke Ges. June 25th, 1925. (254,318.)

20,661. "Aerials for wireless signalling." K. E. Hartridge. August 21st, 1926. (280,999.)

20,739. "Electric heating elements." Hotpoint Electric Appliance Co., Ltd., and W. J. Sims. August 23rd, 1926. (281,004.)

20,802. "Telephone repeater systems." E. Hey (Siemens & Halske Akt. Ges.). August 23rd, 1926. (281,006.)

20,843. "Systems of electric motor control." British Thomson-Houston Co., Ltd., C. J. H. Trutch, J. V. Peacock, and L. R. Nixon. August 24th, 1926. (281,009.)

20,854. "Alternating-current installations for railway and like vehicles." J. Stone & Co., Ltd., and A. E. Honey. August 24th, 1926. (Cognate application 6,457/27.) (281,010.)

21,028. "Galvanic batteries." A. Lewis. August 26th, 1926. (281,018.)

21,045. "Combination loud-speaker devices." W. J. Palmer. August 26th, 1926. (281,019.)

21,083. "Telephone systems." Standard Telephones & Cables, Ltd., and L. B. Haigh. August 26th, 1926. (281,021.)

21,250. "Systems of electric motor control." British Thomson-Houston Co., Ltd., C. J. G. Trutch, J. V. Peacock, and L. R. Nixon. August 28th, 1926. (281,024.)

21,449. "Rheostats or electrical resistances and condensers." J. Anderson. August 31st, 1926. (Cognate application 21,450/26.) (281,026.)

22,630. "Construction of combined electric switch and plug coupling." G. Marr. September 14th, 1926. (281,036.)

22,779. "Electric throw-over switches." H. V. James. September 15th, 1926. (281,038.)

23,014. "Method of improving tone in broadcasting." H. J. Kuchenmeister. September 22nd, 1925. (258,865.)

25,100. "Electromagnetic musical instruments." H. Schumann. October 8th, 1926. (281,057.)

25,758. "Thermionic cathodes." M. O. Valve Co., Ltd., and M. Thompson. October 15th, 1926. (281,060.)

27,491. "Apparatus for the automatic control of arc lamps." E. G. Turner. November 2nd, 1926. (281,069.)

27,574. "Mounting or supporting devices, particularly suitable for holding condensers as used in telephone exchanges." Siemens Bros. & Co., Ltd., and F. Baker. November 3rd, 1926. (281,070.)

28,304. "Means for controlling the speed and power factor of alternating-current slip-ring induction motors." T. E. Houghton and United Alkali Co., Ltd. November 10th, 1926. (281,076.)

28,348. "Railway safety devices." Siemens & Halske Akt. Ges. November 21st, 1925. (261,744.)

28,749. "Apparatus for the production of wire gratings by electric welding of the wires at the intersection points." V. Dobrick. November 15th, 1926. (281,083.)

29,071. "Apparatus for converting alternating electric current into direct current." Bruce Peebles & Co., Ltd., and J. L. La Cour. November 23rd, 1926. (281,087.)

24,791. "Dynamo-electric machines." Electro Dynamic Construction Co., Ltd., and N. Pensabene Perer. November 25th, 1926. (281,089.)

29,862. "Electric ignition apparatus for internal-combustion engines." J. Lucas, Ltd., E. O. Turner and F. W. Handley. November 29th, 1926. (Cognate application 9,136/27.) (281,090.)

32,869. "Means for controlling induction motors fed from rotary synchronous phase convertors." Dr. K. Kando. July 29th, 1926. (275,150.)

1927.

860. "Mercury vapour detectors." British Thomson-Houston Co., Ltd. January 21st, 1926. (264,820.)

954. "Electroresponsive time-lag devices." British Thomson-Houston Co., Ltd. January 23rd, 1926. (264,824.)

2,168. "Toroid windings." Dubilier Condenser Co. (1925), Ltd. March 15th, 1926. (267,474.)

3,162. "Secondary batteries." J. Vaughan-Sherrin. February 3rd, 1927. (Addition to 250,809.) (281,130.)

3,227. "Electrodes for electrolytic cells." R. Pechkranz. February 5th, 1926. (265,646.)

3,730. "Ignition magneto with stationary magnets and armature." R. B. Soc. des Magnetos. March 12th, 1926. (267,481.)

4,754. "Process and apparatus for electrodepositing chromium." L. Mclersh-Jackson (Siemens & Halske Akt. Ges.). February 19th, 1927. (Convention date not granted.) (266,379.)

7,594. "Electrolytic deposition of chromium." General Motors Corporation. June 30th, 1926. (273,659.)

8,175. "Rectifiers for alternating current." Accumulatoren-Fabrik Akt. Ges. March 31st, 1926. (268,764.)

8,362. "Friction-compensating device for the indicating mechanism of electrical measuring apparatus, more particularly for electricity meters." Landis & Gyr Soc. Anon. April 20th, 1926. (269,875.)

8,788. "Quick-acting electric switches." J. Palin. March 30th, 1927. (281,152.)

12,205. "Combined switch and support for electric flat-irons." F. Gentner. May 6th, 1927. (281,166.)

13,427. "Switches for electrically-heated kettles and like containers." Cable Accessories Co., Ltd., F. H. Reeves and S. F. Bickell. May 19th, 1927. (281,172.)

15,215. "Electric water-heating means." A. F. E. Hanson. June 7th, 1927. (281,179.)

15,870. "Receiving apparatus for use in wireless telegraphy and telephony." Telefunken Ges. fur Drahtlose Telegraphie. June 15th, 1926. (272,915.)

15,963. "Electrolytic rectifiers." Soc. Anon. des Etablissements Veuve P. Delafon et Cie. June 15th, 1926. (272,921.)

16,582. "Electrolytic cells." A. K. Croad (Jessup & Moore Paper Co.). June 2nd, 1926. (Divided application on 270,104.) (281,184.)

17,105. "Electric fuses for explosive shells." Rheinische Metallwaaren-und Maschinenfabrik. June 26th, 1926. (273,338.)

17,155. "Electric meters for combining the measurement of power and energy." L. A. Paine. February 3rd, 1927. (281,188.)

17,631. "Methods of cooling dynamo-electric machines." International General Electric Co., Inc. July 2nd, 1926. (273,758.)

18,215. "Processes for the production of aluminium in electric furnaces." Soc. Italiana di Elettro-Chimica. July 8th, 1926. (274,108.)

19,293. "Process for the electrolytic separation of metallic chromium for the preparation of chromium coatings on other metals." R. Appel. July 21st, 1926. (274,882.)

20,611. "Electrical means for controlling lifts and the like." Etablissements Vernes Guinet, Sigros et Cie. August 4th, 1926. (Addition to 259,096.) (275,639.)

21,624. "Piezo-electric relay and the like devices." Telefunken Ges. fur Drahtlose Telegraphie. April 8th, 1926. (Divided application on 9,635/27.) (276,037.)

21,909. "Transformers for radio telephony and the like." J. W. Barber and Brownie Wireless Co. of Great Britain, Ltd. August 19th, 1927. (281,208.)

22,805. "Radio receiving sets of the supersonic or superheterodyne type." Igranic Electric Co., Ltd., and G. A. Mower. August 20th, 1926. (Divided application on 279,580.) (280,836.)

23,071. "Electric regulating systems." British Thomson-Houston Co., Ltd. September 9th, 1926. (Addition to 228,656.) (277,321.)

25,146. "Transformers, inductances, and the like." Etablissements Brunet. September 23rd, 1926. (277,978.)

26,975. "Thermionic amplifying means and associated electrical systems." W. J. Rickets and E. E. Smith. July 13th, 1926. (Divided application on 17,543/26.) (280,841.)

A.S.E.E. "Economic Premiums" Competition.

The 1927 competition held under the auspices of the Association of Supervising Electrical Engineers, took place recently and the examining board has made the following awards:—Members: 1st prize, £10, Mr. B. C. Garman, London, "Economics and Maintenance"; 2nd prize, £5, Mr. W. J. Revell, London, "What is Wrong with the Industry?"; a third paper by Mr. J. Southern, London, "The Economics of Labour," is commended and the writer will receive a bound copy of *Contact*. Associates: 1st prize, £5, Mr. F. Anderson, Glasgow, "Prevention of Accidents in Large Transmission Systems"; 2nd prize, £2 10s., Mr. J. Mulcaster, Darlington, "Power Station—Boiler House Economics."

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ABERYSTWYTH.—Memorial hall, Penparcau; G. T. Bassett, architect.

ASHTON-UNDER-LYNE.—Additional housing scheme (68), Nook Lane, for the T.C.; J. Rowbottom, borough surveyor.

AYRSHIRE.—Housing scheme for Saltcoats Town Council (£15,000); burgh surveyor.

BARNSTAPLE.—Technical school, for Devon E.C.; director of education, Exeter.

BEBINGTON AND BROMBOROUGH.—Houses (378), for the U.D.C.; Walter Hughes, builder, Birkenhead.

BEXHILL.—Houses, De La Warr Road; Harrison & Smith.

BOSTON.—Additional 36 houses, for the T.C.; borough surveyor.

BRADFORD.—Public hall; Special Committee. School at Bierley (£21,483); city architect, Town Hall. Elementary school, Hanworth Street; Education Committee.

BRIGHTON.—Large hall at Pavilion; Pavilion Committee. 48 houses, Baden Road; Brabons, Ltd. Additions, Warwick Street; Southern Transport Co., Ltd. Premises for Johnson Bros. (Brighton), Ltd., Western Road (£18,000); T. Garrett & Son, architects.

BROMLEY (KENT).—Block of 24 shops and houses, London C.C. housing estate, Downham, for A. Frampton.

CARLISLE.—Church and schools (£15,000), for Caldewgate Wesleyan trustees; Rev. C. Oscar Owers.

CHELFORD.—Electricity installation, Residential Schools for Epileptics; Manchester Education Committee.

CHESTERFIELD.—Schools (£12,000), for the Roman Catholic managers; Rev. Father Ross.

CHINGFORD.—National schools (£6,000); Dudley P. Hayworth, architect.

DARLINGTON.—Extensions, Neasham Abbey, for G. Tristram Edwards; Cayley, Lowry & Co., architects, 3, Coniscliffe Road.

DARTFORD.—Alterations, Rialto Cinema, Lowfield Street; Rialto, Ltd.

DAVYHULME.—Electricity installation, Park Hospital; Barton-upon-Irwell Board of Guardians.

DONCASTER.—Congregational Church, Kirk Sandal; trustees. Isolation hospital and sanatorium, for the T.C.; Adshead, Topham & Adshead, architects.

DOUGLAS (I.o.M.).—Electric lighting, Golf Links club house; borough engineer.

EDINBURGH.—Houses and shops for Corporation at Portobello; city architect.

FILEY.—Housing scheme (36), for the U.D.C.; surveyor.

FOLKESTONE.—Motor works, showrooms and garages, for Martin Walter, Ltd.; J. L. S. Dahl, architect.

GLASGOW.—Medico-electrical department at Stobhill Hospital (£30,000), for the Parish Council.

GRANTHAM.—Additional housing scheme (50), for the T.C.; borough surveyor.

GRAYS.—Police court house and station (£32,000), for Essex C.C.; J. Stuart, county architect, Chelmsford.

HAMILTON.—Garage and 'bus station, Burnbank Road, for J. W. & R. Torrance, Ltd., Campbell Street.

HARTLEPOOL.—Housing scheme (48), for the T.C.; borough surveyor.

HASLINGDEN.—Housing scheme; borough surveyor.

HULL.—Reinstatement of Paragon Rubber Works, Air Street, for Major & Co. (several thousand pounds).

KIDDERMINSTER.—Re-erection of spinning mills, for E. Broome & Sons (£70,000).

KINGSBRIDGE.—Grammar school, for Devon E.C.; Director of Education, Exeter.

LINCOLN.—Church, St. Giles, for the Wesleyan trustees; secretary of Wesleyan Circuit. Additional 32 houses, St. Giles, for the T.C.; city surveyor. Houses (51), Bracebridge, for F. W. Horton. Houses (50), Skillingthorpe Road, for Mrs. E. Blank.

LIVERPOOL.—Abattoirs, meat market, &c. (£675,000); city land steward, Municipal Buildings.

LONDON (EAST HAM, E.).—Church of St. Paul (£10,000); Rev. K. W. Sibley, vicar.

(ST. MARYLEBONE, N.W.).—Rehousing for 3,000 displaced by Carlisle Street improvement; L.C.C. Rebuilding Western Ophthalmic Hospital, Marylebone Road; Young and Hall.

(WEST HAM, E.).—Extensions, South Hallsville schools (£11,000), for the borough E.C.; education architect.

LONDON—*contd.*

(FINSBURY, N.).—Sanitary block, Central Foundation Boys' School; governors.

(HACKNEY, E.).—Factory extension, Braydon Road; Thomas and Edge, for International Chemical Co., Ltd. Factory, 14-16, Shore Road.; W. Silk & Son, Ltd.

(HITHER GREEN, S.E.).—Presbyterian Church; secretary, South London Presbytery.

(LEWISHAM, S.E.).—Extensions, Prendergast School (£10,000); governors.

(PECKHAM, S.E.).—Secondary school, Homestall Road; L.C.C. Education Committee.

(HAMMERSMITH, W.).—Extension, Trade School for Girls; L.C.C. Education Committee.

LUTON (BEDS.).—Houses (36), Kingsway, for A. Carter. Factory extensions, for Boutwood & Lyon, 5, Dudley Street, W. F. Mullett, 71 and 73, Guildford Street, and W. Wright & Sons, 6, Bute Street.

MAIDSTONE.—Electric heating, All Saints' Church, for the Parochial Church Council; secretary.

MALVERN.—Bank and shops, Church Street, for the Westminster Bank, Ltd. Concert hall, pump room, foyer, and opera house and theatre (£16,650), for the U.D.C.; Brazier, Ltd., builders, Bromsgrove.

MANSFIELD.—Plaza Theatre; Alfred J. Thraves, architect, Victoria Street, Nottingham.

MERSTHAM (SURREY).—Factory, for the Mackenzie Brick and Tile Co., Ltd., Westminster

MERTHYR.—Sectional garage, Queen's Road and Brynteg Road; Mr. G. W. Bale.

MIDLOTHIAN.—Extensions at West Calder Roman Catholic School (£6,900); clerk, Midlothian Education Authority, Edinburgh.

MOLESEY (SURREY).—Additional 70 houses, for the U.D.C.; surveyor.

MOTHERWELL.—Baths, &c., at Broomside Colliery for Glasgow Iron and Steel Company (£12,700); Murdoch Mackenzie, Ltd., public works contractors.

MUSSELBURGH.—Sports pavilion, halls and baths (£10,000), for Inveresk Paper Co., Ltd.

OBAN.—Roman Catholic cathedral church (£28,000); Bishop of Argyll and the Isles, Oban.

OXFORDSHIRE.—Mental colony; County Council.

PAISLEY.—Shops for Paisley Provident Co-operative Society, Ltd., 25, Causeyside Street; the manager. 164 houses for Corporation; burgh surveyor.

PORTSMOUTH.—Extension tramway depôt, Gladys Road; tramway manager. 59 houses, Paignton Avenue; R. J. Winnicott. 80 houses, Southampton Road, Cosham; Warn & Ogden.

ROTHERHAM.—Extensions, Isolation Hospital; medical officer. Reconstruction showrooms, &c., Sheffield Road; West Riding Motor Co., Ltd.

SHEFFIELD.—Extensions at Lodge Moor Hospital; W. G. Davies, city architect. Electric greyhound racing track, Owlerton, for the Sheffield Stadium & Greyhound Racecourse, Ltd.; secretary, Lowther Road, Owlerton.

SHREWSBURY.—90 houses, racecourse estate; borough engineer.

SOWERBY BRIDGE (YORKS.).—Premises at Bolton Brow, for Sowerby Bridge Industrial Society, Ltd.; Architects' Department, Co-operative Wholesale Society, Ltd., 1, Balloon Street, Manchester.

SPARSHOLT.—Extensions, including dairy block, Farm Institute, for Hants. C.C.; A. L. Roberts, county architect, The Castle, Winchester.

SWANSEA.—First section of new technical buildings (£30,000), for the Corporation Education Committee; borough surveyor.

SWINDON (WILTS.).—Houses (39), for A. J. Colborne. Houses (73), Argyle Street, for Bishop & Fisher.

SHENLEY.—Extensions, mental colony; Middlesex C.C.

TORQUAY.—Extensions, Isolation Hospital (£8,500); borough engineer. Central school (£14,590), for the borough E.C.; R. E. Narracott, builder. Conversion of "Rooklands," into junior secondary school, for the borough E.C.; director of education. Alterations and additions, Royal Theatre, Abbey Road; Theatre Co.

WELWYN GARDEN CITY.—School, for Herts. E.C.; Lieut.-Col. A. Ernest Prescott, county architect, Hatfield.

WEST BROMWICH.—Greyhound racing track, Holyhead Road, for North Birmingham, West Bromwich, and Smethwick Greyhound Racecourse, Ltd., 36, Cannon Street, Birmingham.

WINDSOR.—Extensions, Imperial Service College (£13,000); Clyde Young architect.